THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. FEBRUARY 15, 1900. CHICAGO, ILL. NUMBER 7

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. FEBRUARY 15, 1900. CHICAGO, ILL. NUMBER 7

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

It is becoming plainer as the iron trade goes farther into the year that the foreign demand will be no small factor in determining the course of prices in 1900. The inquiries recently received from the British Isles and from the Continent, and the strong support foreign iron and steel prices bid fair to have, indicate that with only moderate concessions from the present basis our manufacturers could market a large tonnage abroad. The bearing of this condition upon domestic prices is most important. From to-day's outlook it practically precludes any considerable recession in the home market, though it still leaves the trade without the light it seeks as to the approximate basis on which the year's new buying is to be done. Scarce and high-priced fuel is an important factor in the situation both in England and in Germany, and the indications now point to a firmer market in both countries for all iron and steel products. Inquiries for foundry iron continue to come to Southern furnaces, and at concessions of $1 to $2 a ton a large business could be done, with ocean freights on to-day's basis. The large producers of steel and of bars have received good inquiries also from foreign consumers. In rails some export sales have been made in the East at $31 and $32 tidewater. Notwithstanding reports of a $33 price at mill, which were started by resales of several thousand tons in the East, the basis is maintained at $35. The National Steel Co. is now a factor in the rail trade and it appears is working in harmony with the other rail manufacturers. The principal transactions in pig iron the past week have been in the Central West. Sales of 20,000 ton of Bessemer for shipment east of Pittsburg were made on a $24 valley basis, and inquiries have been made by Central Western steel interests for more Bessemer iron for shipment before July 1. The associated furnaces are expected to meet soon to fix a price for Bessemer for the third quarter. Gray forge iron has sold at $21 for Northern and Southern is offered at $20 delivered at Mahoning Valley mill, but association furnaces are firm in asking $21.50. A sale of 3,000 tons has been made at $21 valley. Little has been done in foundry iron. In general the feeling is a shade weaker, and the immediate future turns on the expected buying movement in March. The situation in finished material is little changed. Manufacturers of steel bars agreed to a schedule of delivered prices effective Feb. 1, based on 2.25c at Pittsburg mill. Deliveries to Ohio points are made at 2.35c, which is also the delivered price for Chicago. The development in bar iron is the effort of Eastern manufacturers to get business in that section which has gone heretofore to valley mills, and the basis of 2.20c provided in the Eastern association agreement is not being adhered to. Plates are lower, and 2 15c Pittsburg for tank appears not to be the minimum, while boiler steel has sold at 2.25c. The largely increased plate capacity is making itself more and more felt with every week. The sheet mill consolidation is now practically a fact, all but four concerns, representing 160 out of the 215 mills, having given options to the Moore syndicate. A meeting in Pittsburg this week formulated the plan of consolidation as outlined elsewhere. The market is firm on a basis of 3.05c Pittsburg for No. 27 gauge. There is more activity in the steel market. Negotiations are pending on a contract for 1,500 tons of billets a day, and $35 is believed to be the basis on which the business will be done. Central Western sheet mills are in the market for sheet bars, the uniform quotation being $36 at mill.

PITTSBURG.

OFFICE OF *The Iron Trade Review*.
1125-1126 PARK BUILDING, Feb. 14.

Sales of 20,000 tons of Bessemer the latter part of last week, for Eastern shipment, at the association price, and brisk inquiry in the past few days for iron for almost immediate shipment, have placed the pig iron market on a firmer basis than it has been for several weeks. Negotiations are pending for further purchases of Bessemer at the association price, the greater part of which is for delivery up to July 1. The association price on gray forge is not being maintained very strongly by furnacemen outside of the gentlemen's compact, and sales of 3,000 tons of gray forge, at $21 valley, have been reported. The strain on coke production continues, and a number of furnaces are reported to have made purchases for the first half at $3.50. It is generally believed, however, that by the middle of the year the situation will ease up. Work on hundreds of new ovens is being pushed as rapidly as possible and the coke output will be considerably increased by July 1. The sheet market continues firm. A number of large producers have withdrawn their quotations and are not at all anxious about booking business ahead. It is claimed that the prospects are brighter than ever for the consummation of the sheet makers consolidation.

PIG IRON.—While the association holds gray forge at $21.50 and has made sales at that figure, outside furnacemen are making a lower figure as the sales of 3,000 tons during the past week at $21, valley, would indicate. Foundry iron is still being sold in small lots at prevailing quotations, for immediate delivery. Inquiries, however, have been numerous during the past few days, and it is believed that a buying movement from foundrymen who have been looking for some concessions from the furnaces, will soon set in. The association price on Bessemer is being strictly maintained. We quote as follows:

Bessemer, valley furnace	$24.00
Bessemer, Pittsburg	24 90
No. 1 Foundry	23.75 to 24.00
No. 2 Foundry	23.00 to 23.25
No. 3 Foundry	22.25 to 22.50
Gray Forge, valley furnace	21.00 to 21.50
Gray Forge, Pittsburg	21.25 to 21.75

STEEL.—There is greater activity in the steel market. While no large contracts are being made, numerous small sales have been reported and inquiries have increased. It is rumored that negotiations are pending for the delivery of 1,500 tons of steel daily to one interest, but it is not known whether the contract has been placed. We continue to quote $35 for 4x4 billets and $38 for small billets, at mill, Pittsburg, Wheeling or valley. Sheet bars are quoted at $36, mill.

FERRO-MANGANESE.—We continue the quotation of $125 for domestic 80 per cent.

RAILS AND TRACK MATERIAL.—From the large number of inquiries at hand it is certain that large sales of track material will be made within the next month or six weeks. No sales of rails have been reported. Our quotations follow: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track

material—spikes, 2.50c; track bolts square nuts, 3.60c; hexagon nuts, 3.85c; splice bars, 2.50c to 2.60c; links and pins, 3c to 10c.

SPELTER.—Prime Western grades are held at about 4.80c, Pittsburg.

SKELP.—The demand for skelp continues good with numerous sales in small lots. The market is firm at the following quotations: Grooved iron, 2.15c; grooved steel, 2.15c to 2.20c; sheared iron, 2.25c, and sheared steel, 2.25c to 2.30c.

MUCK BARS.—Consumers are not making large purchases and no contracts have been closed running through the first half. A number of consumers are purchasing from week to week with hopes that a downward movement might set in. We quote $33 to $33.50 as the basis for standard quality, although as high as $33.75 has been asked. These quotations, of course are shaded for scrap muck.

BARS.—The market for both steel and iron bars is reported firmer than for several weeks and 2.25c is being quoted for steel in both large and small lots. If there is any shading from this figure it is being done very quietly. Refined bars are quoted at 2.40c, Pittsburg and common iron bars at 2.15c, valley.

STRUCTURAL MATERIAL.—The mills in this district are working on orders booked some time back. Very little business has been placed during the past few weeks, but the mills will be working on old orders when the increased volume of new business, to be closed within the next few months comes in. We quote the market as follows: Beams and channels, 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees, 2.30c; zees, 2.25c; angles, 2.25c. Universal mill plates, 2.50c to 2.75c, according to delivery and size of order.

PIPES AND TUBES.—The demand continues exceptionally strong with a large amount of business in small lots. No new contracts covering any extended period are taken, however, pending the issuance of the new schedules already prepared. We continue to quote: Merchant pipe, 50 and two 10's for carloads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼ inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—While 2.25c is being generally quoted on tank plates, assorted widths, 2.15c can be done on orders in large lots. The market is easier with a fairly good demand. On extra widths 2.40c continues to be quoted by a few mills. We quote shell steel at 2.35c to 2.45c; flange, 2.50c to 2.60c; fire box, 3¼c to 4c.

SHEETS.—The market is firmer than for some time. A number of large manufacturers have withdrawn their quotations altogether, awaiting something definite concerning the consolidation. Until after the promoters conclude their negotiations it is not probable that any large contracts will be closed. Mills are quoting No. 28 at 3.15c, for delivery up to April 1. Few mills will give quotations for business after this date. Iron sheets are .05c less. Galvanized sheets are also advancing, the majority of mills quoting 75, with the usual 15c freight allowance.

OLD MATERIAL.—One of the local firms purchased during the past week 2,000 tons of cast scrap for delivery within the next three months at $18. Outside of this the market is quiet. There is practically no demand for material for second quarter delivery. Very little new Bessemer and basic melting stock is being offered in this market as the steel mills are working over all their scrap. Our quotations follow: New basic melting stock, $29 to $31; new Bessemer melting stock, $24 to $25; basic open-hearth scrap, $26 to $30; steel rails, mixed lengths, $23 to $25; short lengths, $23.75 to $25.75; iron rails, $25 to $26; cast borings, $13 to $14 gross tons; cast scrap, $18; No. 1 wrought scrap, $24 to $25, net tons; busheling scrap, $16 to $18, net tons.

COKE.—It is reported here that a number of contracts for furnace coke for delivery during the first half have been closed at $3.50. The product continues very scarce, with no indications of a change in the situation until the new ovens which are under construction are fired. Foundry coke also continues scarce and we quote it at $3.50 to $4, the latter figure being the more common. Some sales of furnace coke have been reported at $3.25.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Feb. 14.

General business is increasing in volume right along and the sales of last week show a considerable advance over those of the week previous. The demand for most classes of iron and steel is excellent, and although no very large sales have been made the aggregate tonnage closed is very satisfactory to the mills and furnaces.

PIG IRON.—The market was not as active last week as in the week before, but several quite good sized orders were closed, and the tonnage taken made a good aggregate. The bulk of the business was taken by Southern furnaces, local furnaces being practically out of the market for early deliveries. The demand is good for small lots, and there are a number of inquiries in the market which are expected to develop into orders. Furnaces are very firm in their views, and while some irons are selling at a trifle under the schedule, the standard Southern irons are maintained at full prices. Northern furnaces are not making concessions. The coke situation is unchanged. Both furnaces and foundries find it difficult to secure all that is due them, and considerable complaint is heard because of the shortage. Quotations are made as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	25 00 @ 25 50	Southern No. 1 Soft	22 85 @ 23 35
Local Coke Fdy. No. 2	24 00 @ 25 00	Southern No. 2 Soft	21 85 @ 22 35
Local Coke Fdy. No. 3	23 00 @ 24 00	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	25 00 @ 25 50	Jackson Co. Silveries	31 50 @ 32 00
Local Scotch Fdy. No. 2	24 00 @ 25 00	Ohio Strong Softeners	24 00 @ 25 00
Local Scotch Fdy. No. 3	23 00 @ 24 00	Alabama Car Wheel	25 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	25 00 @ 26 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	25 00 @ 26 00

BARS.—The demand is appreciably better, and sales have increased in number and in volume. The largest order taken last week was one of 3,000 tons, and other business ranged from this down to carloads. A considerable tonnage of inquiries is in the market and is expected to be placed within a short time. Quotations are unchanged and firm at 2.30c for iron and 2.35c for steel, half extras, Chicago delivery.

CAR ORDERS.—No very large contracts for cars were placed last week. A few small orders were given out, and there is more business in sight. The demand for car material of various kinds is good, in small lots, and one good sized order for plates and channels for car works was placed.

RAILS AND TRACK SUPPLIES.—Rail business has been light, and confined to small orders in every case. Quotations follow: Rails, standard sections, $35 to $38; light sections $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.65c to 2.75c; track bolts, 3.85c to 3.95c.

BILLETS AND RODS.—One order for 5,000 tons of billets was taken in this market last week, by a Pittsburg mill, but no other business of any size was closed. Bessemer billets are quoted at $35 and sheet bars at $36, Pittsburg, with $2 added for Chicago delivery. Open-hearth rods are quoted at $65 and Bessemer at $55, by Central Western mills.

PLATES.—The demand continues good, and several quite large contracts have been placed. Good store business is had every day, the total tonnage of this character being large. The market is quite a good deal firmer than a week ago, the number of weak mills lessening with every week. We quote tank steel from store 2.75c to 2.85c. Mill shipments, Chicago delivery: Tank steel 2.50c to 2.60c; shell, 2.55c to 2.65c; flange, 2.65c to 2.70c; marine, 2.75c to 2.85c; fire box, 2.85c and up, according to brand.

STRUCTURAL MATERIAL.—In view of the local labor troubles, which at the present writing seem farther than ever from being settled, little business is expected or received. What orders are placed are of small size, and are nearly all for out of town shipment. There is a large tonnage of contracts in sight, waiting for a settlementof the labor difficulties, and most of this will come in immediately after an agreement is reached between the men and the contractors. Several large railroad orders are in sight, and may be placed at any time. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates 2.50c to 2.60c; universal plates, 2.50c to 2.65c; tees, 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

SHEETS.—Sales continue to incrase in volume, and the demand is better than ever. Most of the business placed in the week was of the small order variety, but one or two good contracts were given out, and there are more to follow. Black sheets are quoted at 3c to 3.15c for No. 27 black, and galvanized at 75 to 75 and 5 per cent off.

MERCHANT STEEL.—Business is being done almost entirely in small lots and no very large business is expected to be placed soon. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—Most of the orders being placed call for small lots, although two or three quite good sized contracts were placed in the week. Quotations are unchanged at 50, 10 and 5 off for small orders, and 50, 10 and 10 off for large orders, mill shipment.

WIRE AND WIRE NAILS.—Business continues good, and as the demand shows no signs of falling off, but on the contrary seems to be increasing, it is expected sales will be large in the future. Jobbers are not buying in especially large quantities, but are making frequent purchases, and the aggregate is larger than ever before. Quotations are firm and unchanged. Makers quote single carloads of wire nails at $3.53, f. o. b. Chicago, and $3.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3.98; galvanized barb wire, $4.13.

OLD MATERIAL.—There is no change in the situation. The demand is not large, and is confined to small lots in almost every case. The market is no stronger than a week ago, and is decidedly weak in some varieties. Quotations made by dealers are about as given below, although in some cases selling prices have been less than these:

Old iron rails, gross,	$24 00@$25 00	Country malleable	$14 00
Old steel rails, long, gr.	22 00	Iron axles, net	$27 00@28 00
Old steel rails, mixed	19 00@19 50	Cast borings, net	9 00@10 00
Relaying rails, gross	28 00@30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	24 00@24 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	13 00@12 50
Dealer's forge, net	16 50@17 00	Mixed country steel, gr	13 50
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@15 00	Heavy melting steel, gr	18 00@19 00
Railway malleable, net	15 00	Old iron splice b., net.	26 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*
27 VINCENT ST., Feb. 1,

Very little is doing in ore, but considerable purchases are yet to be made which buyers seem in no hurry to consummate. The early buying was for choice of ores and in some cases, as with Mesabi ores, by furnace companies interested in Mesabi mines. There are some buyers who have as yet covered little or none of their requirements of old range ores. A transfer in Mesabi property announced in the week is that of the Andrews Bros. Co.'s 12 per cent share in the Mahoning mine to M. A. Hanna & Co. and related furnace interests. The Cambria Steel Co. has 50 per cent of this mine, the American Steel Hoop Co. 20 per cent, the Republic Iron & Steel Co. 12 per cent and the Andrews & Hitchcock Iron Co., 6 per cent.

PIG IRON.—Sales of Bessemer iron for shipment east of Pittsburg have been made at $24 in the valley and there are further inquiries in the hands of the association for Bessemer for delivery before July 1, but difficulty is experienced in finding producers who can accept the business. The valley furnace capacity in Bessemer iron has been increased lately, two furnaces having been turned from foundry to Bessemer. There is some difference in quotations on gray forge iron, some furnaces holding for $21.50, which is the association price, while $21 has been done on Northern iron in the past week, Further business in gray forge is pending. On Southern $15.75, Birmingham, has been maintained for some time, making the price at valley mill $20.20. It is understood that $20 delivered can now be done on Southern mill iron. There has been very little buying of foundry iron in the Cleveland market. Some consumers must make further purchases in March, but it is still a question whether that month will bring a general buying movement. We quote the Cleveland market as follows:

Bessemer	$24 90	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@23 50	Valley Scotch No. 2	22 50@23 00
No. 2 Strong Foundry	22 50@23 00	Gray Forge, valley	21 00@21 50
No. 3 Foundry	21 50@22 00	Lake Superior Charcoal.	25 00@26 00

FINISHED MATERIAL.—The plate mills have been pressing for business in the past week and it is intimated that 2.15c, Pittsburg, which was the minimum up to last week on Bessemer tank plates has been shaded. Eastern mills have been pushing rather more aggressively for business in this territory and have bid below Pittsburg mills in a few cases. We hear of a boiler steel contract on which the basis is in the neighborhood of 2.25c, Pittsburg. The American Shipbuilding Co. is in the market for 2,500 tons of plates and 1,500 tons of shapes for two new boats on which there is figuring. The agreement on steel bars, effective Feb. 1, seems to be maintained, and Cleveland deliveries are now 2.35c, this being the price for all Ohio points to which the freight from Pittsburg is 10c per 100 pounds or over. Where the freight is less the price is based on 2.25c, Pittsburg. In bar iron there is moderate activity. The basis of 2.15c, valley, for common, is generally maintained, though Eastern manufacturers are reported to be making correspondingly lower prices in that territory, and the question of holding trade there is now before the leading Central Western producer. Considerable sales of wrought pipe have been made in the week in view of the general expectation that higher prices will be announced shortly. The sheet market is firm and some mills are refusing to book orders for forward deliveries, having two or three months' business already in hand. In structural material the market is generally quiet. A contract of 600 tons for street car barn construction has been let, but no large building enterprises are on foot.

CINCINNATI.

Feb. 14.

Matthew Addy & Co. comment on the outlook as follows: "Business is going along about as usual, the most significant feature being the inquiries for large lots from the wholesale consumers and their disposition to put off actual buying until the last moment. There is one thing that must be remembered and that is, the great bulk of the iron that will be needed the first half of this year was bought last year. The buying that will take place now will be by those consumers who did not buy quite all they needed and who will piece out their wants from time to time, or by those who believe that the present is the time to buy for delivery during the latter half of the year and so make sure of having their orders booked. There are several great foundation facts in the situation which deserve attention. The first of these is the increasing scarcity of coal and coke being felt at present in the United States, in England and the Continent. This is putting a solid prop under the iron market today. As an example of this, there were this week in Birmingham several offers for cargoes of coal and coke for Spain. The Tennessee Coal, Iron & Railroad Co., has an offer from New England for 100,000 tons of coal and from the Pacific coast for 50,000 tons of coke. Yet the company is not able to handle this; in fact the shortage in the South is so great that last week the Tennessee company ran several furnaces slack, not having a full supply of coke. There never was a time when labor was so absolutely independent as at the present time. Men are being paid larger wages than for years and it is not possible to get as much work out of them as during the times when wages were low. There is not only trouble in running the coal mines, but there is trouble all through the South at the limestone quarries and at the ore mines.

"In January Southern furnaces did not reduce their arrears of pig iron at all; in fact they went into February owing to consumers more iron than they did on Jan. 1. There have been a few odd lots of iron to be sold and these lots have been hawked around here and there, and on a quiet market a great deal more has been heard about them than either their quanitty or importance warranted. Even if not another ton of iron were sold by the leading furnace interest in the South for the next four months it would still have difficulty in that time in bringing its order books up to date. These are the simple facts in the situation, and any careful student of current statistics must be convinced that the position of the iron masters is one of immense strength."

Rogers, Brown & Co. say: "The principal feature of the past week has been the extreme urgency on the part of consumers to have iron sent forward on existing contracts.

The output of furnaces on foundry iron has in general been very disappointing. Many of them have been unable to get sufficient supply of fuel, and have either been blowing light or have been obliged to bank temporarily. The consequence is that the output has been irregular, ranging from high silicon to mottled grades, without a due proportion of No. 1 and No 2 foundry and soft irons. The coke companies, who have a surplus of furnace coke to sell, have been pushing up prices, and the margin of profits for iron producers is nowhere near the figure that is generally supposed. The impression seems to be gaining ground among buyers that it is not reasonable to expect a decline in prices during the continuance of present conditions, and some of those who have been testing the market have purchased round lots for scattered delivery at best quotations obtainable. No. 2 foundry is especially scarce, and those wishing to buy basic iron find there are practically no sellers who will guarantee stated deliveries. The car companies and malleable concerns are greatly inconvenienced by the inability of furnaces to ship promptly, and the output of some of them is curtailed in consequence. There is a disposition still manifest on the part of many buyers to stay out of the market as long as they can, and if, as usually happens, they all come in to cover their requirements at about the same time, there is a possibility that the demand will push quotations higher, at least temporarily."

We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $21.75; No. 2 foundry, $20.75; No. 3 foundry, $19.25; No. 4 and gray forge, $19.75; No. 1 soft, $21.75; No. 2 soft, $20.75; Lake Superior coke No. 1, $23.25 to $23.75; Lake Superior coke No. 2, $22.25 to $22.75; Hanging Rock charcoal No. 1, $25 to $26; Jackson county silvery No. 1, $30 to $31; Standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

PHILADELPHIA.

Feb. 13.

Sentiment in the trade at large appears weaker than at last report. Increasing production of pig iron and the long halt in buying are having their natural result. Even at the concessions of 25 to 50 cents recently reported buyers are not disposed to do business beyond providing for immediately future wants. The production of pig iron is now at a yearly rate beyond 15,000,000 tons. Perhaps the fact that consumption is at this rate is the impressive element in the situation. At all events the feeling is not as buoyant as in the weeks before the opening of the year. To what this will come may not be fully shown for some weeks. Consumers are of the opinion that prices will come down, and they are consistently holding off for their purchases for the latter part of the year and also for iron that will be needed in the second quarter. Some sellers are not making any change in quotations, but as a rule trade is being held by concessions that appear necessary, though there appears no uneasiness among makers about the future. Quoted prices on standard brands are about as follows, for seaboard deliveries, with a rebate of 25 to 50 cents to points within 100 miles south or west of this city: No. 1 foundry, $25 to $25.50; No. 2X foundry, $23 to $24; No. 2 plain, $22.25 to $22.75; mill iron, $20.25 to $20.75. It is reported that the Bessemer output of Eastern Pennsylvania furnaces has been pretty well contracted for up to the middle of the year and beyond. We continue the quotation of $36.50 to $37 on billets. Buyers are not willing to make large contracts at these figures and only small purchases are the result. We quote muck bar at $30.50 to $31 makers' mill, with some activity. The mills are turning out large shipments of finished material on old contracts, and there is also a good distribution of new orders. Prices are somewhat irregular. On bars the Eastern association fixed 2.20c but sales are made at $1 a ton below this figure. The demand is good. Bridge builders, and locomotive and car works are considerable buyers in this and other finished lines. Plates show the anxiety of mills to book business ahead and there is some variation in prices, though the general range is 2.30c to 2.40c on tank. On business in points in the Central West where Pittsburg mills compete, these figures have been shaded. The sheet trade is reported more active, with prices more firmly held. We quote No. 27 at 3.20c. Structural works are filled up with orders and the prospects are good for a continuance of this condition. We quote beams and channels 2.40c to 2.65c; angles, 2.40c to 2.65c for three-inch and larger, and 2.50c to 2.65c under three-inch. Steel bars are quoted 2.50c.

The Tidewater Steel Co., whose plate mill at Chester, Pa., is now in successful operation, has removed its office in Philadelphia from the Crozer Bldg. to 1310 Land Title Bldg.

FOREIGN IRON AND STEEL MARKETS.

The British iron trade on Feb. 1 showed some effects of the South African war. Business was somewhat restricted in warrants, makers being sold heavily ahead. But the tendency was upward. In the Cleveland district No. 3 foundry iron was quoted at $16.75 to $17. Bessemer iron was firm at $19.25 to $19.50. Bessemer warrants, West Coast, were quoted $18.25 to $18.75. Finished material showed considerable advances. Middlesbrough reported an advance of $1.25 a ton in bars and angles, in a week, making a rise of $2.50 a ton in two weeks for bars. Marked bars, South Staffordshire, were quoted $55 to $56 a ton, an advance of nearly $17 in 12 months. Common bars, South Staffordshire, were selling at $50 to $51. Angles were quoted $40 at Middlesbrough and $39.50 at Glasgow; steel rails, $34.50 at Middlesbrough and $34 on the west coast; ship plates $39 to $40, or a slight advance at Middlesbrough, and $41 at Glasgow.

Berlin reports indicate an almost unprecedented abundance of orders in the German iron and steel trade, with indications that the firm state of the market will continue for some time. Coal and raw material continue scarce, with many delays in transit, and generally insufficient rolling stock. Quotations for English raw materials have advanced decidedly, works having either to pay the price or close down. Belgium offers no relief. Foundry pig iron is quoted $20 to $21; Bessemer iron, $23 to $24; forge iron, $19 to $19.50; bar iron, $42 to $45; boiler plates, $49 to $51; thin plates, $44 to $47.

Iron and steel works in France are very busy. At Paris beams are quoted $5.60 per 100 kilos, equivalent to about $51 per net ton; and merchant iron, $5.80 per 100 kilos, equivalent to $53 per net ton. Advices from Brussels are that large export orders are coming in, particularly for Australia. The exports of girders from Belgium in 1899 were 7 per cent less than in 1898, which with the great activity in the trade indicates that the home consumption was much greater than usual.

The Mesta Machine Co., Pittsburg, made the first heat in its roll department of its new works, West Homestead, Pa., this week. This places all the departments in the new plant in operation, including the ingot mold department, steel foundry, machine foundry, chill roll and sand roll foundry, and the machine shop proper. This week the South Side plant of the company, formerly operated by the Robinson-Rea Mfg. Co., was closed down and a number of large machines have already been moved to Homestead. Next Monday the employes of the South Side plant will commence working in the new plant. A 43,000 pound steel casting is being made this week at the Homestead plant. In the roll foundry, there are a 15-ton and an 18-ton air furnace completed, and two 30-ton furnaces nearly completed, while the company is also building two additional 15-ton furnaces and one additional 18 ton furnace. This will make a total of seven furnaces, with a total capacity of 141 tons, which is the largest capacity in air furnaces erected in any single plant. The company also has the largest iron roll making plant in the world. The steel department, containing a 25-ton open-hearth furnace, also makes steel rolls.

Frank Sleath has been appointed superintendent of the Pittsburg & Conneaut Dock Co.'s docks at Conneaut, O., succeeding Capt. E. Day, who has been appointed land captain by the Pittsburg Steamship Co., with headquarters in the company's offices in the Perry-Payne Building, Cleveland.

Those in control of the Uehling casting and conveying apparatus deny that they are about to consolidate their interests with those of Heyl & Patterson, Pittsburg, and the Davies Pig Iron Casting Machine Co., Warren, O.

THE IRON TRADE REVIEW

AND

INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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FEBRUARY 15, 1900.

HIGH PRICES AND CONSTRUCTION.

Achirtects and contractors in all parts of the country have not a little to say through their local papers in the past few weeks about the effect of high prices of material upon the carrying out of building plans. Much work is being figured on and much is in progress. So far as the structural mills are concerned the discussion of the question of prices and of the carrying out or postponement of building plans, is of no immediate moment, for their capacity is engaged for months to come. The prospects now are, indeed, that the structural works will soon face the conditions with which the plate mills wrestled through three quarters of last year.

The very condition that is complained of in some quarters, as though any manufacturer of material or set of manufacturers could remedy it, is only an inseparable feature of prosperous times. The person who has made such profits out of the country's prosperity in the past two years that he is able to build a new home, to take stock in a down-town building enterprise, or it may be to extend the manufacturing plant that has been so favored by good times, is scarcely in position to protest against the manufacturer or seller of his building material sharing in the general advance. And those who have been swelling the general clamor against the present level of prices in iron and steel products, in lumber, in brick, stone, equipment — in every item that enters into building cost — and threatening postponement unless prices come down, may well consider whether their investment is better made under conditions like the present or those that prevailed in 1894 and the two or three year following. True, the difference between to-day's and the panic basis is great, and the shrewd buyer is not attracted by prices generally conceded to represent the climax of a movement. Yet from the standpoint of a manufacturer adding to his plant, the question to be asked is not so much what the cost of the addition will be as how long he may reasonably expect to be able to operate it to full capacity under substantially the present conditions for profit making. There are those who would pay 50 per cent, perhaps 100 per cent, advance even upon the prices of today if they could secure within 30 days a duplicate of their present plant. So great are the possibilities of profit in business offered them, that the enhancement of construction values over a panic basis would be earned back in a few months' operations.

Too often in the decision of the question of new erection, undue prominence is given to the fact of a large increase in first cost. It is to be considered that the country is scarcely two years along on the up grade; and whatever be the precise position of prices this year or next year, the judgment of sagacious men is that plentiful and profitable business is likely for the few years just ahead. In the natural movement of things and leaving out the extraordinary, it is not to be expected that the old mistakes in finance, in industry and in speculation, will be repeated within a decade of the panic of 1893. One impression concerning iron and steel prices, at least, must be reversed, we believe — the idea that within a few years the buyer of material will find the iron trade again at his feet, begging for business at any price, that rolls may be kept turning. The conditions both domestic and world-wide are such — most of them well known and not necessary to repeat—that the iron trade will not soon, if ever, fall into the abject position of recent years. The investor who postpones building till the return of 1-cent steel is in danger of foregoing a good many years of profits from his projected structure.

PERSONAL.

Geo. Burnham, Jr., of the Baldwin Locomotive Works, of Philadelphia, sailed this week for St. Petersburg.

Robert F. Devine has been promoted to succeed the late William J. Devine, as superintendent of the Frankford Steel & Forging Co., at Ellwood City, Pa. Mr. Devine has had large experience in industrial operations and has the reputation of being among the first in his line. It is safe to predict that a steady advance will be made at the Ellwood City plant under his supervision.

Alfred Watters, for a number of years connected with the management of the Crane Iron Co., has become general superintendent of the Thomas Iron Co.'s furnaces, with headquarters at Hokendauqua, Pa.

Samuel W. Vaughn, who recently resigned as superintendent of the Cambria Steel Co., blast furnaces, will, on March 10, become superintendent of the Lorain Steel Co. furnaces at Lorain, O.

John T. Wheeler, formerly in the purchasing department of the Grand Rapids & Indiana Railway Co., at Grand Rapids, Mich., has been appointed purchasing agent of the Sargent Co., Chicago, with office at 675 Old Colony Building.

Thomas Rodd, chief engineer of the Pennsylvania Co, and consulting engineer for the Westinghouse interests, left Pittsburg last week for England, with plans for the new plant of the British Westinghouse Co., at Manchester, Eng. Mr. Rodd expects to be gone about six weeks and before his return will probably submit the plans to Pittsburg contractors for bids. British contractors will also be asked to give estimates and the rivalry between the European and American contractors promises to be interesting.

Mr. James B. McKillips, of the bureau of costs of the Carnegie Steel Co., was promoted last week to the position of assistant auditor. He succeed J. J. Campbell, recently appointed auditor.

H. C. Frick vs. Carnegie Steel Co., Ltd.

Suit for injunction, and in certain contingencies, for receiver, was begun by Henry C. Frick at Pittsburg, Feb. 13, against the Carnegie Steel Co., Ltd., and Mr. Frick's 40 partners in the company. Of the steps that have led up to this sensational proceeding the public has been advised in a measure in the publications that have appeared since Mr. Frick's resignation from the chairmanship of the Carnegie Steel Co. on Dec 4, 1899. Mr. Frick's retirement from official position was the immediate outcome of irreconcilable personal differences between himself and Mr. Carnegie. That these were the occasion of bitter feeling is abundantly evidenced in the petition just filed at Pittsburg. Absentee proprietorship and rigid supervision and revision of the work of partners immediately in charge appear between the lines as original causes of what has grown to be in the past year a complication of disagreements. It is only to be regretted that an organization that has been the envy and admiration of steel manufacturers the world over, and that is in so many respects unique, should now come into a publicity unpleasantly unique, because of personal differences.

Space is not available at the hour at which this is written to give in full Mr. Frick's petition. The Associated Press, moreover, has made this unnecessary, since it has furnished the public with a very liberal synopsis. The suit turns on the differences that have come up over the value of Mr. Frick's 6 per cent interest in the Carnegie Steel Co., Ltd. Figuring prominently is a certain "ironclad agreement" under which partners of Mr. Carnegie, on severing their connection with the firm were to sell to the Carnegie Steel Co., Ltd., their holdings at their book value. This ironclad agreement is not thus described in the petition, but it is referred to as a "certain so called ironclad agreement." Mr. Frick's contention is that the books of the company "do not now and have not recently contained a reasonable valuation of its assets. A very large quantity of its assets on the first day of January, 1900, stood upon its books at very inadequate valuations."

It is stated that on Jan. 15 Mr. Carnegie and other partners "who had been forced by him to sign the same" presented Mr. Frick a notice "purporting to be given under and in pursuance of said so-called ironclad agreement." This called for the transfer by Mr. Frick of his interest to the company. He declined to comply on the basis offered, which was about $6,000,000. On Feb. 1, it is averred, President Schwab, at Mr. Carnegie's instance, had Mr. Frick's interest transferred on the company's books. "Carnegie further contends that he need not nor will not pay for your orator's interest what it is fairly worth, but that he can only be compelled to pay a price which will be determined by himself and by the partners he controls. This price, he contends, can only be demanded by your orator in such small installments during a term of years of such duration as will, probably, not only enable the company to entirely pay for your orator's interest by using the share of the profits applicable to them, but have a surplus left to the company. Thus, it is a part of Carnegie's scheme not only to seize your orator's interest, but to make it pay for itself out of the profits, and thereafter leave Carnegie, in large part, the owner of said interests, with a large surplus of money besides." Farther on the petition says: "Your orator denies that there is or was when said notice was given any contract under which the defendants have acquired, or lawfully can acquire, his interest in said firm." It is also denied, and this is an important contention in the suit, that the Carnegie Steel Co., Ltd., formed July 1, 1892, is a limited partnership. Mr. Frick says he did not know until January, of this year, that the partnership was general, with individual liability, and not limited, with liability restricted to the capital. He made the discovery in consulting attorneys concerning the issues that had been raised.

Three offers are made in the petition by Mr. Frick, which may be summarized as follows:

(a)—To sell his interests in the firm at what three business men will judge them to be fairly worth.

(b)—To execute new papers making a valid, binding, limited partnership, and to continue the firm, in all respects, as it was intended heretofore to do.

(c)—To continue the firm, even if it is a general partnership and all are individually liable, provided he be allowed to participate in the management, because to leave the sole management to Carnegie would result eventually as he (Frick) believes, in financial loss.

If Mr. Carnegie refuses all these offers, Mr. Frick asks the court to dissolve the partnership and to have a receiver appointed to sell the property, pay the debts and distribute the balance. Injunctions are asked for to prevent the transfer of Mr. Frick's interest, as made on the books of the company; to restrain the defendants from conducting the business without permitting Mr. Frick to participate therein. A decree is asked annulling the "pretended transfer" of Mr. Frick's interest and ordering the defendants to cancel on the books of the company all entries of improper and insufficient valuations of its assets.

Some Inner Facts and Figures.

Without attempting to give consecutively or in detail Mr. Frick's allegations, we have selected some of the salient points of the petition, as it relates to the partnership interests, the personnel and the effort made to buy out Mr. Carnegie's interest last year:

"The percentage holdings in the Carnegie Steel Co., Ltd., as they stood Dec. 30, 1899, are as follows: Andrew Carnegie, 58½ per cent; Henry Phipps, Jr., 11; H. C. Frick, 6; George Lauder, 4; C. M. Schwab, 3; H. M. Curry, 2; W. H. Singer, 2; L. C. Phipps, 2; A. R. Peacock, 2, F. T. F. Lovejoy, ⅗; Thomas Morrison, ⅗; George H. Wightman, ⅗; D. M. Clemson, ⅗; James Gayley 11-18; A. M. Moreland, 11-18; Charles L. Taylor, ½; A. R. Whitney, ½; W. W. Blackburn, ½; John C. Fleming, ½; Ogden Hoffman, ½; Millard Hunsiker, ½; George E. McCague, ½; James Scott, ½; H. P. Bope, 1-9; W. E. Corey, ½; Joseph E. Schwab, ½; L. T. Brown, 2-9; D. G. Kerr, 1-9; H. J. Lindsay, 1-9; E. F. Wood, 1-9; H. E. Tener, Jr., 1-9; George Megrew, 1-9; G. D. Packer, 1-9; W. B. Dickson, 1-9; A. C. Case, 1-9; John McLeod, 1-9; Charles W. Baker, 1-9; undivded, F. T. F. Lovejoy, trustee, ½; total, 100 per cent, $25,000,000.

"Changes since Dec. 30, 1899: H. P. Bope bought 1-18; P. T. Berg bought 1-18; A. C. Dinkey bought 1-18; James Gayley bought 1-18; A. R. Hunt bought 1-18; Charles McCreery bought 1-18; total, 7-18. Held by F. T. F. Lovejoy, trustee, Dec 30, 1899, ½ per cent; held by F. T. F. Lovejoy, trustee, Jan. 1, 1900, 1-9 per cent. This indicates that at the beginning of the present year four new partners were admitted, namely, A. R. Hunt, A. C. Dinkey, P. T. Berg, and Charles McCreery, and that Messrs. Bope and Gayley increased their holdings at that time, the former by 1-9 of 1 per cent and the latter by 1-18 of 1 per cent."

Of special interest are the statements as to the value of the company's business; the price at which Mr. Carnegie's interest was to be acquired last summer, in the Moore Brothers' deal; the circumstances attending Mr. Frick's resignation and the reasons therefor, and the attitude of Messrs. Phipps, Curry and Lovejoy in the present controversy. These are contained in the following extract:

"The business of the Carnegie Steel Co., Ltd., especially during the last few years, has been enormously successful and profitable. With the then outlook Carnegie estimated in November, 1899, that it will realize from its business for the year 1900 a profit of $40,000,000, and I then and now believe that said profit will exceed $40,000,000. During the year ending Dec. 31, 1899, its net profits were $21,000,000.

"Its assets on the 31st of December, 1899, were clearly worth more than $250,000,000. Within the last few months Carnegie has asserted the fair value thereof to be greatly in excess of that sum. He has further asserted that they are of such value that in ordinary times of peace and reasonable business prosperity in England the same could be readily placed on the London market on the basis of £100,000,000. Since the making of these assertions the value of these assts has largely increased.

"Within the year 1899 huge additions to and improvements of the works have been completed, thereby adding enormously to their producing power. Other additions and improvements, now in course of construction, which will still further greatly increase said producing power and future profits, will soon be completed.

"For various reasons, none just, not necessary now to be

stated, but which will appear hereafter in the taking of the testimony, Carnegie has recently conceived a personal animosity toward your orator. This partly arose from the failure of your orator, in connection with others, to avail of an option given by Carnegie in consideration of the sum of $1,170,000, to Carnegie paid, and now retained by him, as a forfeit to purchase his (Carnegie's) interest in said steel company, limited, for the sum of about $157,950,000, which sum Carnegie insisted should be so preferred and secured that he would virtually have a first mortgage on all the partnership assets and thus gain a preference over all his partners.

"As has been heretofore said, on the 4th day of December, 1899, without good reason, and from malevolent motives toward me, Carnegie demanded the resignation by your orator of his office of chairman of said company. This resignation in the interest of harmony was tendered. Since that time Carnegie has secured control of the whole association and of its affairs, and has compelled the co-partners, other than Henry Phipps, Jr., F. T. F. Lovejoy and Henry M. Curry, and perhaps others, who refused to carry out his orders and desires, to pass such resolutions and do such acts as he dictated, without regard to their conformity to their real wishes, or to their judgment, as to the true policy of the association. Many of the partners were unable or unwilling to incur his animosity, lest he might attempt to forfeit their interests in the association. Some of them were practically unable to resist his will because of their large indebtedness thereto.

"In order that he might injure your orator, whilst benefiting himself, Carnegie conceived a scheme to forfeit the interest of your orator in the association, worth upwards of $15,000,000, in such way as would not oblige him to pay therefor one-half of its real value, and would enable him to make payment therefor in small installments at very long intervals of time."

It would thus appear that the difference between the amount Mr. Carnegie is willing to pay for Mr. Frick's interest and the amount the latter considers it worth is about $10,000,000.

RATIONAL FOUNDRY DESIGN.

Foundry work is so much unlike that of the other departments of a large manufacturing establishment that many employers and managers know very little about it, and are afraid to meddle much with it. Molding is a dirty trade, and few employers have gone through its routine as they have through the other shops and offices. There is, therefore, still much charlatanism in this department. Purchases are effected, and arrangements adopted without special knowledge, and the molder is blamed if appliances and materials do not fulfill expectations. Employers who would see the folly of attempting to equip all machine shops alike will commit the error of fitting up a foundry in such and such a way because some one else has one equipped in that manner.

The result is that many existing foundries reflect no credit on the wealthy firms who own them, being ill lighted, ill ventilated, cold and hot by turns, destitute of labor-saving arrangements, and ill supplied with suitable appliances generally. Or, on the other hand, they have been fitted up at great expense with appliances which are not adapted to the character of the work. Then blame is thrown on the foremen and molders as an unprogressive, ignorant set. To such firms reform will come only under the severe pressure of outside competition, which will render necessary the mending or the ending of the business. When laying out a new foundry the designer is confronted with many problems, which are not easily solved. A common formula is utterly impossible. Each individual case must be studied and resolved on its own merits. To mention a few alternatives is the best way to state the difficulty. Which is the best method of transposition,—rails laid down for trolleys, or flat plates, or overhead trolley tracks? How is a general solution possible? Again, what proportion should overhead travelers bear to swing cranes? Some would swear by the first, others by the last. Then as regards motive power, should this be steam, electricity or compressed air, and, if this is settled, which particular system of the many offered is preferable? In reference to methods of doing work, at what stage shall hand work be displaced by machine work; and if the latter is decided on, what machines and what operating agents are best? Outside of these mechanical problems lie those which deal with the working arrangements of the shop, the best location of stores, the extent to which subdivision of labor shall be carried, and much besides.

It is clear, therefore, that there is but one course open to the foundry designer, and that it to thoroughly gauge the requirements of a given works, the average weekly tonnage, the character of the castings to be made,—whether light or heavy,—the proportion of green sand to loam, the proportion of core making, including whatever relates to these matters; and last, though not least, the probable extent of future expansion. Then, having a grip on these, the coat must be cut according to the cloth, and the foundry designed to fulfill these needs as far as the governing conditions will permit it.—[Joseph Horner, in Cassier's Magazine for February.

The Sheet Mill Consolidation.

(Special Telegram.)

PITTSBURG, Feb. 14.—It was announced today that options have been secured on 160 of the 215 sheet mills of the country for the proposed consolidation. The four concerns that refused to give options on the remaining 55 mills are Zug & Co., Pittsburg; Apollo Iron & Steel Co., Vandergrift, Pa.; W. Dewees Wood Co., McKeesport, Pa.; Whitaker Iron Co., Wheeling, W. Va. The committees representing the Iron and Steel Sheet Manufacturers' Association, consisting of J. G. Battelle, Piqua, O.; A. W. Brown, Cambridge, O.; B. M. Caldwell, Bridgeport, O., and the promoters Judge W. H. Moore and his brother James H. Moore, of Chicago, met here yesterday afternoon and formulated the basis of the consolidation.

The new company is to be capitalized at $52,000 000, one-half of which is to be represented in common and the rest in preferred stock. The actual value of the plants is represented at $16,000,000 of the preferred stock and $10,000,000 is to be placed in the treasury of the consolidation as a working capital. The entire issue of the common stock is to be placed in a New York bank for one year at least before being placed upon the market and it may be even later than that date before it is offered for sale.

The minimum quotation fixed for sheets is 3.05c for No. 27 gauge and 3.10c for 28 gauge. Galvanized will be held at 75 off and a 15 cent freight allowance as a minimum. Very few of the mills, however, will sell sheets at less than 3.20c for above gauges. Officers of the new company will be elected within 30 days.

Steel by the Jones Direct Process.

The Carteret Steel Co. is starting up the plant of the old Warren Iron Co., at Washington, N. J., and proposes to make steel by the Jones direct process, invented by Henry A. Jones, of Brooklyn, N. Y. The open-hearth furnace at this plant has been completely rebuilt. It differs from the usual type in that around the furnace proper, which is burdened in the usual way, are zigzag retorts or deoxidizers, heated by gas. The ore pulverized and mixed with coke, is admitted through hoppers and when molten, passes into the furnace proper at the zone of fusion. This metal is expected to be free from carbon and enters the furnace escaping the zone of carbonization. The metal coming from the furnace is expected to be of a superior grade and readily and cheaply converted into steel in the open-hearth furnace. Steel of a very high and uniform grade has actually been made in small quantities.

IT is reported that the Ashland Iron & Steel Co., of Ashland, Wis., has acquired practically a half interest in the West Colby Mining Co., the stockholders in which are Ashland capitalists. Wm. E. Werder is president of the mining company and W. H. Hinkle, secretary and treasurer.

THE Straight Line Engine Co., Syracuse, N. Y., is exceedingly busy, having now from six to eight months' work ahead.

THE IRON AND STEEL STOCK MARKET.

Denison, Prior & Co. say in their weekly iron and steel letter: "Although the past week has recorded a check upon the rapid upward movement of the common issues of the iron and steel companies, we are pleased to note that the halt in the advance has been of a different character from any heretofore experienced. There are many reasons why these common stocks should occupy a position of greater favor now with the conservative investor and speculator, than they did a year ago. The speculation in them during the early part of 1899 might be termed erratic to say the least. The buying of today is based upon the actual showing of earnings, and not upon promises of what will be done. The policy of the American Steel & Wire Co. in displaying a properly audited account of their year's transactions has done more to place the common issues of the steel companies on a firm basis in the confidence of the public, than any action that could have been taken. Their declaration of a dividend was a secondary matter. The fact that they are capable of earning a dividend on their vast capital more than fulfills the promise made by the promoters of the company.

"The Federal Steel Co., is pursuing a similar policy, and on Tuesday, Feb. 13, declared two quarterly dividends of 1¼ per cent each on the common stock. It is said that the National Steel Co. and the American Steel Hoop Co. will follow the action of the other companies mentioned, and will issue statements of their earnings and declare dividends upon their common stocks, which, of course, will be very gratifying to their stockholders.

"The present condition of the stock market is rather an indefinite one. There is a large contingent in the market which believes that the result of the present era of prosperities have been discounted and as if the market should begin to reflect a change from that condition to one of lesser activity in the commercial world. On the other hand there are many well posted operators who firmly believe that the present trade conditions in the country will not only continue, but that business will become broader and better than any that has been seen. It is the clash between these two parties that holds the market on its present level. Trade reports do not indicate that there has been any cessation in commercial activity; on the contrary indications are that the pace has not only been maintained but that it is increasing. In the money market there is no fear expressed of any marked change in conditions."

The table below shows the changes in the iron and stee stocks in the week ending Feb. 11, also the high and low points for the year:

Name.	WEEK.				YEAR.			
	Open	High	Low	Close	High.		Low.	
Am. Car & Fdy	163¼	:8	161½	161½	18	Feb. 7	123½	Jan. 15
Am. Car & Fdy pr.	64½	66	64	64½	66	Feb. 6	59	Jan. 29
Am. Steel & Wire..	58¼	59¼	56⅝	57⅜	59¼	Feb. 6	45¾	Jan. 15
AmSteel & Wire pr	95	95	93	93	95	Feb. 1	89	Jan. 15
Am. Steel Hoop.....	48¼	50½	46⅝	46⅝	50¼	Feb. 6	41⅜	Jan. 17
Am. Steel Hoop pr	84	86	84	84⅞	86	Feb. 6	80	Jan. 23
Am. Tin Plate.....	33¾	36⅝	33¾	34⅝	36⅝	Feb. 7	27⅞	Jan. 29
Am. Tin Plate pr..	83	83	82½	82½	83	Jan. 2	80⅛	Jan. 11
Col. Fuel & Iron...	47	48½	45	45¾	48½	Feb. 8	40½	Jan. 8
Federal Steel.....	56¼	57¾	54½	55⅛	57¾	Feb. 6	47¾	Jan. 11
Federal Steel pr....	75⅜	77½	75	75	77½	Feb. 6	70¾	Jan. 10
National Steel.....	49½	53½	47¾	49	53⅝	Feb. 6	40	Jan. 26
National Steel pr..	95	97	95	96	97	Feb. 6	91	Jan. 9
Pressed Steel Car..	58¼	58¾	55¾	55¾	58¾	Jan. 17	55⅝	Jan. 26
PressedSteelCar pr	88	88	87½	87½	88½	Jan. 17	85½	Jan. 9
Republic Steel	26	27½	24½	24⅞	27½	Feb 6	10⅜	Jan. 15
Republic Steel pr..	69¾	70¾	68½	68½	70¾	Feb. 6	64¾	Jan. 18
Tenn. Coal & Iron	100⅞	101½	95¾	95⅝	104	Feb. 2	79¾	Jan 11

Shaking Out Castings Hot or Cold.

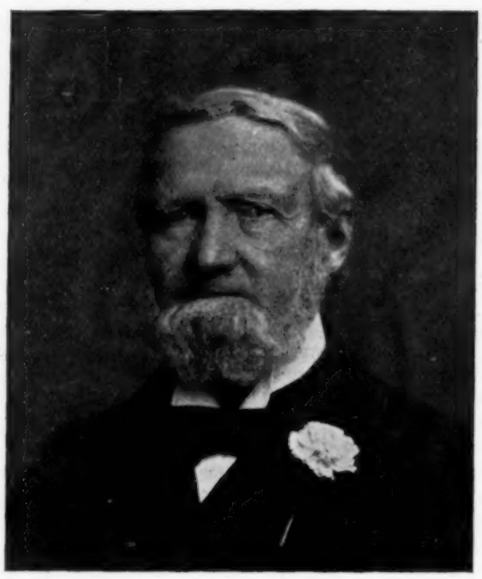
An inquirer in the *Foundry* asks "whether it adds to the strength of the common agricultural gray iron castings to leave them in the sand until perfectly cool, or is there any advantage gained over the ordinary practice of shaking out hot. Our test bars go to show that those shaken out hot are slightly stronger?" To which Mr. W. J. Keep makes reply: "It does not make much difference in strength when small castings are removed from the mold if they are not red hot. The slower a casting cools from the fluid state until it ceases to be red hot the larger will be its grain. Strength depends almost entirely on the size of the grain and on the firmness in which they knit together. Therefore, as your test bars show the castings removed while they are red hot will cool faster and will have a slightly smaller grain and be a little stronger.

"The reason for leaving a casting in the mold is not to make it stronger in the way a test bar shows it, but is to prevent warping or the formation of internal strains. By slow cooling after the casting ceases to be red hot the particles have time to adjust themselves, and have a less tendency to pull apart. A casting that would crack if shaken out hot would not crack if left in the mold until entirely cold. The casting as a whole is therefore stronger, while the metal itself is slightly weaker. In castings having heavy and light portions it is sometimes necessary to leave some portions covered and to scrape the sand away from other parts. The whole object is to so cool a casting that internal strains are avoided."

A VETERAN FOUNDRYMAN.

An Octogenarian Who is Still Active in the Business.

In a day when to an increasing extent young men are holding responsible places in industry, the continued participation in management by one who has passed out of the seventies is especially noteworthy. On Friday, Feb. 9, N. P. Bowler, for years head of the foundry firm of Bowler & Co., of Cleveland, celebrated his eightieth birthday, and hundreds of friends called upon him to pay their respects and extend



N. P. BOWLER.

congratulations. Mr. Bowler was born in Scoharie county, New York, Feb. 9, 1820, of parents descended from John Alden and Priscilla Mullins, of the Mayflower. His early business experience was in mercantile lines. In 1849 he entered the office of a Cleveland foundry and a few years later became a foundry proprietor, having thus been identified with the business for half a century, the firm of Bowler & Co. being in existence most of that time. He is president also of the Cleveland Frog & Crossing Co. and a director of the Cleveland Steel Casting Co. For a number of years he was president of the association maintained among Cleveland foundrymen, which preceded the present organization. He continues to carry in an active way the responsibilities of foundry management, being unusually alert and always alive to the rapidly crowding developments in latter-day business.

THE core-makers in Cleveland foundries have adjusted their differences with their employes. The men complied with the condition imposed by the foundrymen that work be resumed pending a settlement, and the conference resulted in the granting of a $2.50 minimum, the arrangement to continue to Dec. 31.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

The Effect of Annealing on the Magnetic Properties of Steel Sheets. (*Stahl und Eisen*, Dec. 1 and 15)—The behavior of the laminated field magnets and armature cores in dynamo construction is so peculiar at times that much attention has been given to this matter by the great electrical companies. Methods with tedious details have been devised, the object of which is to produce a uniformly reliable product so far as its magnetic permeability is concerned. The need of more light on the subject is in fact so urgent that a special committee was authorized, at the recent convention of the American section of the International Society for Testing Materials, to look into the behavior of iron and steel under electrical influences. Mr. Hans Kamps gives us some data of interest on one phase of the question. The problem of the chemical composition of iron as related to its magnetic properties is still unsolved. We know that the three great divisions of iron give corresponding readily distinguishable magnetic effects. When, however, it comes to a study of each division, that is, wrought iron, steel and cast iron, the laws of magnetic permeability, which should be well defined in their relation to the variations in composition, cannot be traced as yet. The reason for this is patent. Not only does the chemical composition affect the magnetic properties of iron, but also the heat and mechanical treatment it has received. As long as it is impossible to give two pieces of sheet iron exactly the same treatment in the fire it is useless to analyze them and predict their magnetic permeability. It is necessary, therefore, to learn the actual effects of heating and forging a piece of iron or steel in order that a rational system of annealing dynamo material may be devised. It is a well known fact that annealing sheet iron for magnetic purposes sometimes improves it, and sometimes does the reverse. Why this should be the case we cannot as yet say.

The points to be investigated would seem to be: (1) the maximum temperature of the anneal; (2) the duration of the heating process, and (3), the rapidity of heating and cooling, with a noting of the effects of possible irregularities in process. Mr. Kamps suggests the use of a small electric furnace to carry out these experiments, as it is impracticable to do work of this kind in regular factories without serious interference with the daily routine. The experiments made on the duration of anneal given by the author show that the results were negative, no effect due to a variation in time of anneal being proven. Nevertheless the data are of great interest in connection with the study of the theories of magnetic changes during annealing. A series of eight test strips taken from two sheets was secured. These were all heated to the same temperature, but varied in length of anneal from 35 hours for the short anneal to 48 hours for the long. The Koepsel system of testing was used, and before the separate trials were made each piece was magnetized and demagnetized several times. The influence of the earth's magnetism was carefully eliminated and the mean of a number of measurements taken. The maximum difference in losses by hysteresis in the eight samples before annealing amounted to 21.6 per cent of the highest amount. Four of the samples were now subjected to an annealing process of short duration. While all of the samples were improved magnetically, yet the maximum difference in the losses by hysteresis increased to 56.5 per cent of the highest amount as compared with 16.8 per cent before annealing these particular four samples. The second lot of four test strips were now annealed for a long period. The results showed no variation of note when compared with those from the short anneal. The second lot was now re-annealed for a short period and the first lot divided, one portion being annealed for a short period again and the other for a long one. The results show a marked deterioration in the magnetic qualities. All samples were now subjected to a further long continued anneal Here again the result was a much poorer magnetic quality. The summary of the tests would seem to indicate that the first anneal of the samples made a material of much better magnetic qualities, and all succeeding trials were useless, in fact detrimental.

The questions which now arise are: (1) In what manner does the anneal affect the magnetic character of the sample? (2) Why does it improve the material in the one case and spoil it in the others? (3) Why is the annealing effect irregular in the various samples? We have as yet no satisfactory solutions to record. Light is shed upon the subject, however, by the recent discoveries on the nature of hardening steel and the microstructure of metals. It is to be supposed that magnetic changes due to annealing must be accompanied with physical or chemical changes in constitution, such as a change in the grain, the microstructure, and the form of carbon and iron. A continuation of these influences must be of far reaching effect upon the magnetic properties. For instance, we know that a hardening of the material means an increase in the loss through hysteresis. Again the fact is patent that hardening a steel means that its carbon has been changed in form. Heat a piece of ingot iron or soft steel to cherry red and the carbon is in one form only—hardening carbon—and is combined with the iron as "Martensite." Cool this iron to 1,560 degrees F. and pure iron begins to separate out. The interesting fact may now be reported that at this critical point the temperature coefficient for the electrical resistance is suddenly modified. Above 1,560 degrees F. there is no change noticeable in this coefficient. Cool the iron down to 1,380 degrees F. and another critical point is reached, evidently as Mr. Kamp thinks, the one at which the nature of iron changes from a hard to a soft one. This point is the upper limit of the susceptibility of iron to magnetization; it will neither retain residual magnetism nor receive any by induction. The third and last critical point is reached when cooling down down to 1,250 degrees F.—the point of recalescence—when the hardening carbon changes to carbide carbon. Below this point it is impossible to harden steel, and this naturally affects the magnetic properties likewise. These critical points are reversed when the iron is heated. The hardening carbon may be readily separated from the carbide carbon by chemical means, the former being soluble only in hot acids, while the latter escapes as a gaseous carbo-hydrate when treated with cold nitric or hydrochloric acids.

The much mooted question whether iron is allotropic or not is founded upon physical phenomena. The circumstance that the various critical points of steel come closer together, in fact unite into a single one, when a high carbon steel is reached, indicates that several explanations of the hardening property shown by steel are possible and of equal weight. Osmond and his followers attribute it to the presence of allotropic hard iron, which is prevented from becoming soft by the presence of carbon Ledebur, on the contrary, together with his adherents, can get along without allotropic iron and attribute the hardening of steel to the amount of hardening carbon present alone. Howe takes a position half way between, with the carbo-allotropic theory, by which the combination of hardening carbon and allotropic iron are said to account for the peculiar power of steel to harden when heated to a high temperature and quenched. If we were to assume that a greater or smaller amount of allotropic hard iron in the sheets to be magnetized accounts for the greater or smaller losses by hysteresis, the influence of hardening carbon is not so apparent, for the very softest steel is universally used for laminated magnets. As this amount of carbon is seldom above a few hundredths of one per cent, and the proportion of hardening carbon in this total carbon reduces this still more, we can assume that a well annealed piece of dynamo sheet steel contains only traces of hardening carbon, or not enough to account for marked changes in its magnetic properties. A more potent phenomenon is the remarkable coincidence of the critical points at which the forms of carbon change and the magnetic permeability is lost. The change of the magnetic properties with the change from soft to hard iron may be best attributed to the last mentioned occurrence. It is impossible to explain the increased losses from hysteresis by cold working in any other way than a change in iron from soft to hard. Cold working by damaging the crystalline structure, creating a greater number of smaller crystals, may increase the adhesion of the crystalline mass and therefore make the work of remagnetizing a little heavier, but then a change in the form of carbon is not brought about by mechanical means.

There seems to be only the allotropic theory of iron remaining to account for the changes in the magnetic properties of

an iron under anneal, for. take the well known theory of fatigue of metals and apply it to the "ageing" of dynamo sheet iron, and one finds that the carbon conditions here are not changed at all. Nevertheless the continued remagnetization must necessarily affect the molecular conditions somewhat by reason of the internal friction produced, and when the carbon is very high its effect more than counterbalances that of a possible change from soft to hard allotropic iron for in making permanent magnets the effect of the carbon present is especially intensified by the addition of chromium, tungsten, titanium, etc. Summarizing the above points we find that the magnetic changes produced by annealing are caused by the changes in the proportion of hard and soft iron present as well as hardening and carbide carbon, but what their relative value may be must be left an open question. In order to make use of the above explanation for obtaining practical results we must revert to the phenomena observed in the rapidity of the cooling of an iron at the critical points, this factor determining the proportion of the unchanged allotropic iron and hardening carbon remaining behind. It would appear that the change from soft to allotropic hard iron, as well as carbide to hardening carbon can be effected instantaneously, whereas the reverse operation is a matter of some time. It would seem to follow that the duration of the cooling process in annealing sheet iron has everything to do with the magnetic changes effected therein, while it is immaterial whether the metal was brought to the required temperature quickly or not. If a very hot piece of sheet iron is cooled fairly quick the temperature drops rapidly about the critical points and the consequent hardening noticed has a very bad effect upon the magnetic properties observed. Rolling sheet iron produces this effect at every pass, and careful annealing is always resorted to if good magnetic results are required. It is sometimes noticed that the same anneal improves some plates and spoils others. This is due to the different position of the critical points in the two materials, a fluctuation in the speed of cooling striking one point slowly with good results, and the other rapidly with poor ones. It is therefore necessary to heat up to a point beyond the highest critical point of the material and then cool slowly and uniformly. The presence of manganese and nickel reduces the critical points very materially. Thus a 12 per cent manganese steel would be expected to be inert to magnetism at ordinary temperatures. This is really the case with Mr. Hatfield's manganese steel.

Regarding the influence of chemical composition upon the magnetic properties of an iron much can be said. So far only iron and carbon have been found of direct influence, the other elements being but of secondary importance. Thus silicon and aluminum remove gases and thus increase the permeability of an iron. Phosphorus, manganese and silicon affect the size of the crystal and thus also the magnetic properties. The effect of varying quantities often gives opposite results. Thus a 12 per cent manganese steel cannot be magnetized, but add more manganese and it is again amenable to magnetic influences. The size of the grain is quite influential, for with it the adhesive forces change, and the molecular friction incident to demagnetization and remagnetization varies likewise. One can readily see a relation between size of grain and magnetic permeability. Unfortunately we can prove little of the deductions given above by direct experiment, for we cannot distinguish the allotropic states of iron by chemical analysis, though they are theoretically in existence. Nevertheless systematic trials should be made right along to get at a basis for properly annealing sheet iron for dynamo purposes so that the highest magnetic results may always be obtainable.

Heat Treatment on Medium Carbon Steel. [*Trans. Am. Inst. Mining Engineers*, Dec., 1899]—Mr. R. G. Morse describes some experiments made by heating .35 carbon steel in different ways and subjecting the treated bars to physical and microscopic tests. The object was to determine how tensile strength, elastic limit and size of grain were affected by heating to successive temperatures between 930 and 2,370 degrees F. and subsequent slow cooling. Three-quarter-inch round rods, one foot in length, and rolled from the same bar, were used. They were heated to the desired temperature while enclosed in wrought iron tubes to prevent oxidation; time of heating was one-half, one, and three hours. When heated sufficiently the rods were imbedded in lime to cool slowly and uniformly. The Le Chatelier pyrometer was used to determine all temperatures. After tensile tests sections were cut off and microphotographs made. The areas of the ferrite grains were measured and the percentages of ferrite and pearlyte calculated by their specific gravities—ferrite being 7.90 and pearlyte 7.84. An interesting diagram shows the relation of strength to grain area, the critical points being well marked. A series of 26 photo-engravures illustrate the paper. The discussion of results gives the follows ing: Increasing the temperature of the steel regularly brings about a corresponding reduction in the elastic limit. The changes in the ultimate strength, elongation and reduction in area are not so marked. The area of the grains of the steel as shown by the microstructure are fairly regular until 1,220 degrees F. is reached, when they begin to grow smaller, reaching their minimum at 1,650 degrees F. The steel now begins to change its appearance and at 2,375 degrees F. a complex structure is the result, simple grains being changed to banded and lamellar forms. An interesting result is the striking similarity between a specimen heated for half an hour at 1,220 degrees F. and another heated to 1,830 degrees F. and cooled immediately. The point raised by the author is whether the heating to lower temperatures for longer periods will give the same results as a short stay in an intensely hot furnace, a point of sufficient interest to manufacturers to be looked into more carefully.

COMPETITION IN AMERICAN IRON AND STEEL.*

BY WM. GARRETT.

I believe our country's greatness and prosperity are mostly due to protection from foreign competition, thus encouraging home industry. Two things will stand forever to the credit of American manufacturers: 1. They never sold their product at the price of foreign goods, with the duty added. 2. They never reduced their common labor to the level of the pauper labor abroad, though being compelled, from 1893 to 1898, to sell their product at a less price than the same product cost in the pauper labor countries. When the Morrill tariff bill was passed, Mr. Zug, senior partner of Zug & Co. of Pittsburg, said: "I am sorry the high duty policy has been adopted, for while it will surely tend to cut down foreign competition, it will encourage and stimulate home competition, and I dread home competition more than I do foreign competition." He little knew in what a prophetic strain he spoke; and many of the great champions of protection, such as Morrill, Kelly, Garfield, and Blaine, must have turned in their graves, some time in the period between 1893 and 1898, when our manufactured products were sold at less than in free trade countries. Who is there among us here, who did not experience a cold chill on reading what was called "Blaine's prophecy," that if once free trade became a law, this country would be compelled to meet the low cost of free trade labor, and would become a howling wilderness? Who has forgotten the flow of eloquence during the debate on the Wilson bill? What a struggle between the giants of intellect! On one hand, it was stated that the amount of duty was a tax to the American consumer, not taking into consideration the cost of the American product at that time. On the other hand, it was stated that if the American manufacturer was ever compelled to produce his goods for the same cost as in free trade countries, then our factories would be closed, and our men would be idle, when right at that time iron and steel were sold in Pittsburg for less than on the European market. All this brought about by American competition.

It is said that "hunger knows no law;" neither does unbridled competition. All honor, honesty and veracity go by the board. Gentlemen's understandings became a dead letter during the crazy period of unbridled competition, from 1893 to 1897. Pools would be formed like pie crust, only to be broken. Manufacturers would meet and put up a small forfeit and take oath pledging themselves not to sell their product for less than a certain price, and then, as soon as the meeting was over many of them would rush with the haste of a war correspondent at the front, and wire their agents who were

*Extracts from an address before the Illinois Manufacturers' Association, at Chicago, December 13, 1899.

waiting in their respective territories, to sell and load up at a little less than the agreed price.

In quoting for foreign business, the American manufacturer would sometimes bid $2 or $3 lower than was necessary to secure the order. What the English manufacturer told the speaker was true, when he said: "You Americans may beat us at manufacturing, but we can beat you at selling; we are better merchants, in fact." Such cutting of prices was simply suicidal. Yet all this time, the fossilized advocates of free trade sang the old parrot song, "the tariff is a tax." What brought about this stampede in the cutting of prices, so that iron and steel was sold lower than anywhere in the world, right in Pittsburg, a manufacturing city in a country that has posed before the world as a leader in civilization? One of the great planks in our political platform that brought about our unparralleled prosperity of 1892, was protection to American industries through duties on foreign imports. But why sell for even less than the free trade countries with their pauper labor? Simply unbridled competition, increased production, and under consumption. Why, pig iron has been sold in the Birmingham district for $6 per ton, and

Bessemer pig in Pittsburg at . . .	$ 9.00	per ton.
Soft steel billets in the valleys at . .	13.50	"
Wire rods in Pittsburg and Chicago at	19.50	"
Steel rails at	16.00	"
Bar iron and steel at	20.00	"
Steel strips for making pipe at . . .	19.00	"
Plates at	26.00	"
Barb wire (plain) at	1.50	per 100 lbs.
Wire nails at less than	1.00	"

These are about the lowest prices that iron and steel have been sold at in any part of the world, and all this when every article I have mentioned carried more or less duty, and at a time also when the government had a deficit and looked with a hungry eye to getting some revenue from foreign imports. If I were to be asked what was the most colossal political blunder and miscalculation, I would say it was by the framers of the Wilson and the Dingley bills. For in spite of the conditions surrounding them at that time, they expected to increase the revenue—in the one case by decreasing the duty on iron and steel, and in the other by increasing the duty on these products. Tariff for revenue only, from imports of iron and steel to this country, is as dead as one of the mummies lying at the base of the Pyramids. Competition trampled our tariff laws under foot. Natural laws are stronger than any laws made by man. The law of supply and demand controls production and prices, and the "survival of the fittest" is as much in force to-day as it ever was.

Another factor that aggravated matters was the increased production. In the manufacture of iron and steel in this country on a large scale, it is generally the custom to have blast furnaces in connection with the finishing mills—notably the Carnegie Steel Co. and the Illinois Steel Co. And a blast furnace must be run continuously, or a great loss will be the result, so they had to keep going even at a loss—the loss in operation being less than the loss in being idle. This, and the many improvements devised by the manufacturers, not only to save labor but to increase production; and added to all the free silver craze that spread itself like a mildew all over the country, caused a distrust among business men and buying ceased to a great extent. In the meantime, our free trade neighbors in Europe were jogging along nicely, getting from 25 to 30 per cent more for their iron and steel, and paying dividends right along, while our American manufacturers ran riot in reckless competition. I firmly believe that just as much material would have been sold during our last panic if the price had been increased 25 per cent.

But was there no good whatever derived from our terrible experience? In such fierce competition, there was a cloud that had a silver lining; for we were forced to seek an outside market, and we did. Ten years ago few if any American products in the shape of finished iron and steel could be found outside of the United States. Since then we have shipped many thousand tons abroad. When I look back only a few years, some very interesting features present themselves. I find in 1895 John W. Gates, then president of the Illinois Steel Co., in a hot controversy with the Chicago *Tribune* on the tariff question, because some foreign rail makers had delivered rails on the Pacific Coast, Mr. Gates claiming that the duty on rails was too low. In 1897 I saw billets and wire rods, made by the Illinois Steel Co., in France and Great Britain. The former country had to pay a duty on the rods. In 1899 I find that the Illinois Steel Co. has secured a large order for rails and railway material to be delivered in Glasgow, Scotland. I find, in the early part of 1899, Mr. Carnegie engaged with some New York papers in a hot controversy on the expansion question; and one of his strongest arguments in favor of the United States withdrawing its troops at once from Manila, was that Manila was of no earthly use to this country, as a customer for our products, seeing that it was thousands of miles nearer to British, German, and other European competitors. But at the same time the Carnegie Steel Co. had shipped many thousand tons of shipbuilding plates to the Clyde in Scotland, and had shipped thousands of tons of structural steel to Belgium—the cheapest points of manufacture in Europe. They were also supplying the American Steel & Wire Co. with 4-inch soft steel billets, which were converted into wire and shipped to all parts of the world. And I venture to make the assertion that the saying "The sun never sets on the immense empire of Charles the Fifth," might truly be changed to read, "The sun never sets on the material made by the Carnegie Steel Co." All this brought about by American competition. And I believe the present policy of our government is a wise one, i.e., holding on to what we have fought for and won, until at least the people of these islands are capable of governing themselves intelligently, and then leaving an open door for our produce in competition with all the other manufacturers of the world. This is our only salvation—free commerce with all the nations of the world.

At the present time we are in one of the most prosperous periods in our history, if not the most prosperous, while just two years ago we were almost in despair and nearly collapsed with the low prices and hard times. Ere the funeral meats of a panic were cold, we have come upon one of the greatest booms we have ever experienced. Two years ago things seemed stagnant, while to-day every factory in the land is overcrowded with work; and pig iron is $24 a ton, against $9.25 a little over a year ago. What has brought about this great prosperity, all over the land? Was it done by special legislation, by some act of Congress? Have we put a stop to "crucifying the people of this country on a cross of gold?" I believe no man has ever been able to predict in advance the eras of prosperity and calamity. They are like the wind that bloweth where it listeth, and it is hard to tell whence it cometh and whither it goeth; but we are in it. I have heard some say that outside of the general confidence the business men have in the present administration, Joseph Leiter was the first to give the stagnant pool a stir, by his attempted corner in wheat. That at least gave the farmer his dollar a bushel for wheat, and the prosperity of the farmer is the foundation of the prosperity of the country. Then J. W. Gates put the brake on the ruinously wild competition in wire products; after which others got into line, until to-day we have the most gigantic combinations the world ever heard of. But this movement and the action of the consumer—who in turn seems to have lost all judgment—have brought about the most astounding results, so far as profits in manufacturing is concerned.

I have been told that the city of Pittsburg to-day is producing more wealth than any other city in the world. The Klondike gold mines are nothing in comparison; and all engaged in the iron and steel business are piling up wealth at an enormous rate. Their buying up ore beds, coke plants, steam ships, and railroads has alarmed the people, who do not know where this will end. But in my opinion, no trust or combination can exist for any great length of time in this country. The spirit and enterprise of the people and Providence's bountiful gift to us in coal and ore, distributed North, South, East and West; the millions of tons of iron and steel on the surface of the country; the basic open-hearth process that can utilize high phosphorus ore, which can be found in almost any State in the Union—all will combine to prevent monopoly in iron and steel. And when normal conditions are reached once more, the man who has his plant properly located geographically, who has the most improved equipment, his stock unwatered, and with all good business management, will be the man that will win. And one of the greatest agents that eventually will check and overthrow all combinations in the steel business, will be the basic open-hearth steel process, inasmuch as less capital is required to commence operation, the raw material can never be cornered, and the product is more suitable for general use than Bessemer steel. I believe that the prophecy of the late Mr. Holley, made years ago, that the open-hearth process would be in at the funeral of the Bessemer converter, will yet be fulfilled.

THE FRACTURE OF PIG IRON.

BY EDWARD KIRK.

It has been the practice of foundrymen and blast furnace men, for many years, and we might say ever since pig iron was first produced from a blast furnace, to judge and grade the iron by the fracture of a freshly broken pig. This practice of grading iron is now being rapidly replaced by grading from chemical analysis, which will no doubt prove more accurate to the majority of foundrymen. Yet a practice that has been in vogue for so many years must have some merit, and a few points from the old school may be of value to the foundry chemist, as well as to foundrymen.

The characteristics of pig iron are as accurately indicated by the fracture, to the man who has acquired the art of judging iron by fracture, as they are by chemical analysis. This may seem a radical statement to the strong advocates of chemical analysis but it is none the less correct. There are many castings in existence today, made many years ago, for which the iron was chosen by fracture, that are in no way inferior to those made by chemical analysis. and in many cases superior to them. There are foundrymen today to whom the practice indicates as accurately the characteristics of an iron as does a chemical analysis. The uncertainty of judging irons by fracture comes not from the fracture not accurately indicating the characteristics of the iron, but from the foundryman not being able to judge its characteristics, in fact, few foundrymen have given the matter of fracture sufficient attention to become fracture experts.

Among those whom the writer has met, who may be classed as fracture experts was Frank Lawrence, for many years foreman of the American Stove and Hollow Ware Co.'s foundry, and for more than 20 years and up to the date of his death a few years ago, the iron and cupola expert of the Isaac H. Shepherd Stove Works, Philadelphia, Pa. Mr. Lawrence could look at and feel the fresh fracture of a pig and say accurately whether it would or would not make a soft, strong stove plate. And he could determine in the same way, whether two or more irons when melted together would produce a soft, strong plate, and was never known to fail when left to use his own judgment of irons. He was one of the first foundrymen to use high silicon, or silver-gray iron, as it was then called, in a stove plate mixture and melted many tons of it, when other founders condemned it as a worthless rotten iron.

Another expert of iron fracture is Thomas Magee, foreman of the Bushill Iron Works for many years and up to the time the works were closed, to make room for the new United States Mint now being built at Philadelphia. The specialty of this works was large rolls for rolling mills, and the success of the business which enabled the proprietor, Mr. Moore, to retire with a fortune was largely due to Mr. Magee's knowledge of iron fracture, which enabled him to turn out rolls of any required degree of softness, hardness and strength.

There are no doubt many other fracture experts employed in the various foundries throughout the country. They will generally be found in foundries making a specialty that requires a good quality of iron. The writer has met with some success in judging irons in this way, although by no means an expert, and many old foundrymen in different parts of the country will remember that he melted in their foundries iron which had been condemned and had lain in the yard for years. One of the successes in this line was at the Union Stove Works, Peekskill, N. Y., in 1876, when a large lot of iron which had been condemned and had lain in the foundry yards for five years or more was melted with another iron, said to be inferior, and a good soft strong iron for stove plate produced. Neither one of these irons had ever been seen or melted before by the writer and the mixture was made from the indication of the fracture without previous knowledge of the characteristics of the iron. Other successes met with were at the foundries of Perry & Co., and Rathbone, Sord & Co., Albany, N. Y., in 1876. The irons used at these foundries at that time, were Crane, Allentown, Thomas, Hudson and Jager. These irons Nos. 1 and 2 had been used for years in the stove foundries in this locality and produced a soft, strong plate, but they had suddenly begun to run hard, while the fracture to all appearance indicated the same characteristics as when they ran soft. A mixture of these irons in various proportions produced an uneven, hard plate. The hardness was first attributed to one iron and then to another, which in turn were left out of the mixture, and finally to the No. 2, which was all left out, and at the foundry of Rathbone, Sord & Co. only No. 1 Crane, Allentown and Thomas were being used when the writer visited their foundry.

This mixture of No. 1 irons produced what the writer termed a sandwich iron, from the tendency of the hard iron to separate from the soft iron and form in a thin plate between two thin plates of soft iron. This frequently occurred over a large surface in plates not more than 3-16-inch in thickness. It would also separate from the soft iron in heavy parts such as lugs and one lug of a door or side might drill perfectly soft and free, and another drill free part way through, when a hard iron would be found that could not be penetrated with the drill.

This characteristic of these No. 1 irons was afterwards found to be due to an attempt by the blast furnacemen to reduce the cost of their product by using a cheap Jersey ore, the iron from which did not unite with the iron from their other ores. To overcome this difficulty, it was suggested to Colonel Young, the foundry superintendent, and a foundryman of many years' experience, that the fracture of the No. 2 iron indicated a softer and more even iron than the No. 1 and that a mixture of all No. 2 Crane, Allentown, Thomas and Jager be made. The Jager iron had been condemned and not used for some time, and the idea of making a mixture of this iron, the No. 1 of which was said to run hard, with all No. 2 of the other brands, which were also said to run hard, was too absurd to be seriously considered by the Colonel. But after some success had been met with in melting Jager and No. 2 at the foundry of Perry & Co., the Colonel, not having improved on his mixture, was induced to try a charge of the above for grates and fire backs. This proved so satisfactory that an entire heat was melted from the mixture and a soft, strong, even plate produced.

Numerous other instances might be given of judging by fracture irons never seen before but these are probably sufficient to show that the characteristics of iron are indicated accurately by the fresh fracture. Irons are generally judged by the color, size, shape, brightness, dullness, smoothness, sharpness, and regularity of the crystals in the fracture of a newly broken pig. A dark color is said to indicate a soft iron; a light color a hard iron; a large crystal, a soft iron; a small crystal, a close or hard iron; a bright iron, a fluid iron; a dull crystal, a non-fluid iron; a smooth crystal, a weak iron; a sharp pointed crystal, a strong iron; and an irregular crystal, an uneven iron that will run hard in spots.

The majority of foundrymen judge iron by these characteristics and they can generally predict very accurately from them in irons to which they have become accustomed, any change that may take place in the castings. But the majority of them can not judge accurately irons, the fracture of which they are not familiar with, and for this reason they are very slow to try new brands of iron. They frequently pay $1 or $2 a ton more for iron than the price of an equally good iron. The reason why they are unable to judge one iron as correctly as another, is that different ores impart to iron a peculiar characteristic, that is apparent to those who have not made a study of fracture in different brands of iron. This is illustrated in the case of the Crane, Allentown and Thomas irons above referred to. The Colonel was able to judge these irons correctly, so long as the same ores were used, but when a change was made in the ores he was all at sea, and increased the quantity of hard iron and decreased the soft, in his mixture, when a soft iron was desired. It may be asked, were not the No. 1 and No. 2 irons made from the same mixture of ores, and should they not have presented the same characteristics? They were made from the same ores and may have been made from the same cast in the furnace, yet they present entirely different fracture characteristics to the close observer and gave entirely different results when remelted. In the No. 2 the hard iron had blended and united with the soft iron, while in the extremely soft No. 1 it had not united and when remelted separated from it in the casting. This phenomenon in iron will be explained when melting shot and burned iron. The furnacemen, at whose furnaces these irons were made, employed chemists to ascertain the cause of this peculiar characteristic of the irons; but

they were unable to determine the cause, or suggest a remedy. And it is doubtful, even with the advancement made in the chemistry of iron at the present time, whether a chemist would meet with any more success in handling this peculiar iron; for I do not think an analysis would show that the hard iron would separate from the soft when remelted.

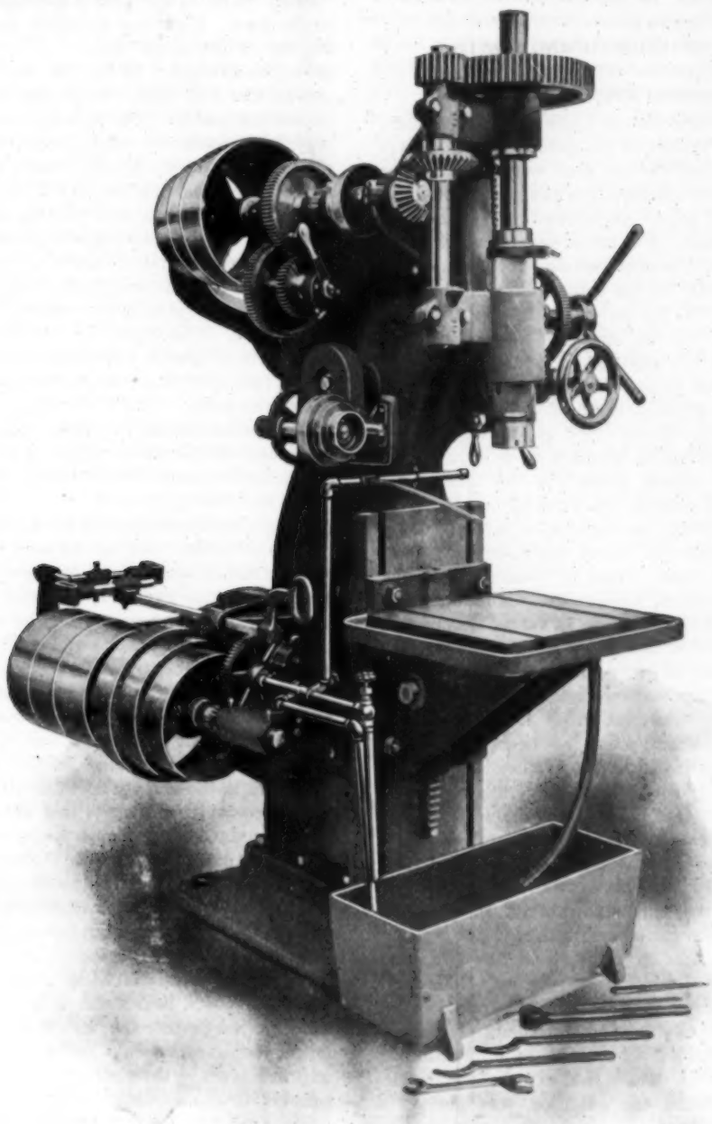
To attempt to illustrate the characteristics of fracture in pig iron, would only be a waste of space, for neither the artist, the engraver, nor the press, can reproduce them on paper in a way that would be of any value to the reader. To attempt to describe them so minutely as to enable the reader accurately to judge an iron would be equally useless, but a few points on the fallacies in fracture may be of value:

The sow and the sow end of a pig shows a larger crystal and more open iron than the tail end of the pig. The pig when broken in the center is said to show the average crystal of the pig and to indicate the quality of iron, but it does not always do so. The iron may be more accurately judged by breaking the pig near the ends and comparing the fractures. If the sow end indicates a very soft iron, and the tail end a hard or very close iron, the iron will run hard in a light casting, and harder in a heavy casting some distance from the gate than near it. A sharp-pointed drawn-out crystal indicates a strong iron. This may be deceptive, as the shape of the crystal can be changed to some extent, by the way in which the iron is broken. A pig broken with numerous light blows will show a sharper pointed crystal than the same pig when broken with one heavy blow. This of course does not apply to high silicon irons, that break at the lightest tap of the sledge. A dark bluish fracture shows a soft iron, and a light silvery fracture a hard iron. This is changed by the presence of silicon, and a light colored crystal may indicate a softer iron than a dark one; but the dark fracture is the stronger and better foundry iron. A high silicon iron without crystal and a white hard iron present similar fractures and are distinguished from each other by the silicon or soft iron having a light bluish cast and a dull ring, while the hard iron has a whitish cast and a sharp ring.

Philadelphia, Feb. 6, 1900.

AUTOMATIC DRILLING AND TAPPING MACHINE.

A new type of drilling and tapping machine is shown in the accompanying illustration. It is a heavy tool and is particularly adapted for drilling, tapping, counterboring and facing such work as pipe fittings, drop forgings, boring small engine and pump cylinders, parts of agricultural machinery,



AUTOMATIC DRILLING AND TAPPING MACHINE.

steel gears and pinions—work in which the pieces themselves are not large, yet require that a considerable amount of metal be removed. The special features combined are power self feed, lever feed, hand worm feed, automatic stop and quick return for spindle. The feeding mechanism is very heavy, the worm gear being of steel and driven by a hardened steel worm running in oil. It is also heavily back geared, the rate of back gearing being 1 to 13, and is arranged for tapping by the addition of extra pulleys for carrying open and cross belts.

There are six changes of speed for the main spindle and by means of a compound feeding device six changes of feed are obtained for each spindle speed. This covers every range of work from boring ordinary holes ¼-inch in diameter up

to facing heavy steel forgings 8 inches in diameter or boring 10 or 12-inch cylinders. The spindle is 2¾ inches in diameter, of crucible steel, and is counterbalanced and fitted with hardened tool steel ball thrust bearings. All pinions are made of steel. The tables are of the bracket form and are massive, to prevent springing. The countershafts are always attached to the main frame as shown in cut. These drills are made so that they can be used as a single machine, or, by means of brackets any number can be bolted together, forming a gang. A suitable pump geared directly to the countershaft is furnished, fitted and connected with each drill or gang of drills and machines are piped for conveying the lubricant to the drill. These machines are built in three different sizes with 11-inch, 14-inch and 16-inch spindle feeds. Baker Brothers, No. 100-130 Post st., Toledo, O., are the manufacturers.

READJUSTMENT OF IRON MINING COSTS.*

BY WILLIAM KELLY.

We of the younger generation of Lake Superior miners have often heard glowing stories of the golden period of $12 ore, but that price is recorded for one year only, a year more memorable for the Jay Cooke failure, the panic year of 1873. After the resumption of specie payments in '79, the iron business had its record boom. For three years the price was high. Then a lower plane was accepted and for the succeeding 10 years, beginning with '83, the price from year to year varied less than before. Of the 10 years the price of five years, viz.: '85, '86, '87, '88, '89, and '92 was $5.50; 1884, $5.75; 1891, $6; 1883, $6.25; 1890, $6.50; 1887, $7.25. The average of the 10 years was $5.92. Passing over 1893, which was disturbed by the silver panic, the next six years show as follows: 1894, $2.75; 1895, $3.50; 1896, $4.50; 1897, $3.18; 1898, $3.64; 1899, $3.65, giving an average of $3.54, a reduction of 40 per cent. The figures given for the later years cover ores now considered special, the price for the fictitious ore of fixed composition, which has been taken as the basis for valuing Bessemer ore for the last three years, being respectively 53, 89 and 70 cents less. Were it possible, however, to compute the average price of all ores, the reduction would be equally striking. How the change in values was met by the mines, it is the purpose of this paper to consider.

At the outset, credit must be given for the share of the reduction borne by the transportation interests. But how it was possible for vessels to carry ore from Duluth to Lake Erie ports for 60 cents a ton, and how the vesesls have developed in size and equipment is another story. And his is not the place to consider in detail the modernizing of the Lake Superior railroads. The importance of one tendancy of industrialism—the increase in the size of the units handled—both parts of the transportation system clearly demonstrate. The fall in price necessarily bore down first on profits. But they were quite insufficient for such a strain and the pressure of reduction had to be met principally in the cost.

The period under consideration is not marked by any notable invention. Nitro-glycerine and the power drill had long been common places. Nor can the results be attributed to the general reduction of previously unknown methods or the extensive application of untried forces. It is impossible to point out one or even any few causes that explain the reduction of costs. At every mine the situation was met in a different way. The variety of the solutions, the ingenuity of their conception, and the courage of their adoption make the subject of the reduction of costs of mining ore on the older ranges of Lake Superior a fitting topic to present to this Institute.

Viewed from the standpoint of an accountant, the cost of ore is found by multiplying the amount of labor by the rates of wages, adding the supplies consumed multiplied by the price, adding again certain charges, such as royalty, taxes, insurance, etc., and dividing the sum by the output. It seems proper to present the subject in this manner, because it emphasizes the importance of the output. Many elements make up the expenditure, the numerator of the fraction, but the denominator consists of one term only. The surest way to reduce the cost is to increase the output, while every element of the expenditure may be increased if it enables a corresponding or greater increase in the output.

Lower Cost with Reduced Output.

Few who have not been through it can appreciate the agony of heart which seized us when in the fall of '93 and the opening months of '94 we realized that greater reductions must be made in cost to insure a continuance of operations and were confronted with the appalling condition that at the same time the output must be reduced enormously. It seemed as if, like the children of Israel in Egypt, we were asked to make bricks without straw. As dead work and the harder stopes were discontinued, it was pathetic to realize that even more men had to be turned adrift than the proportional reduction in output indicated.

From '72 to '85 the yearly average shipments were under 40,000 tons. Eighteen hundred and eighty-seven was the hey day of the small mine. A 50,000-ton mine was then above the average. In 1892 the average rose to over 100 000 tons for the first time. From 1892 to 1896 may be called the 100,000-ton period. The average for 1892 was 104 000 tons; 1893, being under the influence of the panic, 73,000 tons; 1894, 108,000 tons; 1895, 102,000 tons, and 1896, 101,000 tons. A part of the shipments for '94, '95 and '96 was ore carried over from previous years and during that time the producing power of the mines was restrained. In 1897 the average of shipments rose to 120,000 tons, in 1898, to 165,000 tons and in 1899 it was 159,000 tons. From this it appears that larger outputs have assisted to reduce costs principally during the last three years. The deposits of ore from which the tremendous shipments of recent years have been made, with perhaps one or two exceptions, were known and more or less exploited before the panic. The difficulty in marketing ore held back its extraction, and on the other hand, the possibilities of development of the older ranges, together with the unfolding of the wealth of the Mesabi, were potent factors in bearing prices and retarding effort.

By far the largest part of the expenditures in mining operations is for labor. During the hard times every effort was put forth to reduce the amount of labor per ton. When the panic broke, the mines generally were in a fair state of development. The only question being as to whether they should run at all, prospecting was abadoned and dead work stopped. This was a great help to the cost for a couple of years, but after awhile mining caught up to the developments and dead work had to be resumed. Stopping the dead work could be only a temporary expedient in the reduction of costs. It served its purpose and tided over the crisis. In many cases a permanent reduction in the amount of labor has been found in a change in the system of mining or in a change of details in its application, and it is probable that the necessities of the period have in some measure helped to effect the change. Where conditions make it possible to adopt a caving or settling system, the saving was often considerable, both in work and in timber, and there are a number of instances where this may be considered as the greatest gain that has been made, but it cannot be considered as a general explanation of the reduction in costs, because in a great many mines the conditions did not permit the adoption of such a method. Such mines sought other ways to reduce. Some were able to make improvements in their mining system. Thus, in rooming in timbers, it was possible in some places to catch more ore in chutes than had formerly been the practice, and thereby save in shoveling.

Economizing Equipment.

The substitution of other power for hand power has been hastened. The field which afforded the greatest opportunity for development was that of transporting the ore from stopes to stockpiles and pockets. Before the panic three rope haulage plants had been established undergound, though two of them were afterwards given up. The large deposits under Lake Angeline were a particularly favorable field for mechanical haulage and electric systems were adopted before the panic. Subsequently at a number of other mines, mules were successfully introduced and helped materially to reduce the cost. Later a chain haulage plant was installed at the Chapin and the latest appliance to bid for honors is the pneumatic locomotive at the Aragon. A reduction in the cost of tramming permits of a further important saving by increasing the economi-

*Synopsis of the Presidential address before the Lake Superior Mining Institute, Iron Mountain, Mich., Feb. 6, 1900.

cal distance between shafts. Fewer shafts need be sunk and greater quantities of ore are made tributary to each. Some changes, too, may be noted in the method of hoisting. In many of the deeper mines, where the hoisting of men is an important matter, cages were early adopted and the practice with them was formerly quite general of rasing the mine car to the surface and carrying the ore in it from stope to pocket. When different grades were being separated this plan seemed to afford less danger of mistake or mixing. But many of these mines, while retaining cages to transport men and timber, now hoist the ore in skips. The danger of mixing was a bug-a-boo and the saving has been considerable. Hoisting in skips leads naturally to some mechanical arrangement for conveying the ore from shaft to pocket or trestle and the last few years have seen several commendable methods put into operation.

The size of the units handled has increased rather slowly. The heaviest load of ore at the iron mines is five tons and the number of mines at which three tons are hoisted is very small. The usual load is two tons. In many cases the pay load is but a small fraction of the capacity of the hoisting plant. The last few years have undoubtedly seen progress, but there still remains room for considerable improvement at many mines, both in size of the cars and in the loads for the hoist.

Steam shovels have been used about the mines for a number of years; but at the beginning of the period under consideration, there were still many mines which relied on hand labor for loading the stockpiles. Every spring appeared stout, hardy men who applied for stockpile work. But they came in fewer numbers, until now the stockpile man has ceased to exist. In some cases the steam shovel may have driven him away, but in many others the shovel filled a vacancy. It may be said in general terms that the steam shovel has multiplied the efficiency of labor in the neighborhood of six fold and reduced the cost of loading one-half.

We cannot note any extension in the use of machinery for the framing of timber, for the reverse is undoubtedly the case. This is due partly to the use of smaller or less timber and partly to the fact that the framing mills so far tried have not been satisfactory. It is, however, a proper field for the use of machinery.

Under the necessity for retrenchment, the duties of every position were carefully scrutinized and readjusted. Thus a skip tender was dispensed with at one level by putting in a speaking tube to the next, or a skip tender was entrusted with the care of the pump, or a dry man required to look after the oils, or an oil man to make wedges. Those who had held the abolished places were not necessarily dismissed, but when possible, were added to the forces more actively engaged in increasing production.

The question as to how much attention should be paid to appearances is always with us, but hard times naturally magnify the utilitarian side of the case.

The Labor Factor.

We come now to the second factor in the general formula which we have used to represent expenditure, the price of labor. Upon the reduction of forces in 1893, wages were reduced; for the most of 1894 they were 25 per cent lower than they had been in 1891 and 1892, and the efficiency of labor was excellent. Though wages rose slightly in 1895, it was a year of dissatisfaction. In the early part of 1896 wages were raised to the 1892 level in expectation of a good year, but with the political outlook threatening the standard of values, the hopes were not realized, and wages and prices fell again, to gradually rise once more in '98 and '99 with the advent of prosperity, until now they are generally higher than this generation of workers has known. We have learned that the efficiency of labor does not depend upon the absolute amount of the wage, but upon its fairness, in consideration of the condition of business. The fair and equitable rate of wages may be sometimes high and sometimes low. If both parties concede the fairness of the rate, labor is efficient; if the basis is unfair, or thought to be unfair, there must be loss or friction.

Saving in Cost of Supplies.

The amount of supplies consumed received most careful attention. Fuel, timber and powder are usually the principal items in the list, though some mines with water power require little fuel; others have such conditions of rock and ore as to need little timber, and some require but little powder. We have therefore considered under the head of labor saving, some economics that have been effected by the greater use of mechanical power. At the same time there has been a great improvement in machinery which has reduced the fuel bill. As the depth of the mines increases, and the flow of water enlarges, pumping, necessarily continuous, takes a large amount of power. When it becomes necessary to lift 1,800,000 tons of water a year 1,000 feet, 2,000,000 tons 800 feet, 1,300,000 tons 1,330 feet, 2,200,000 tons 560 feet or 2,200,000 tons 750 feet,—figures furnished by our mines on the Menominee range—the principal question is which machine is the most economical, and we have seen installed several triple expansion direct acting pumps and one compound flywheel pump, giving duties of over 90,000,000 foot pounds. High class compressors with compound steam and air cylinders and improved valve motions have been coming into use as few ones are needed. Too often compressors are continued in use that consume an excess of fuel, enough to pay for a good compressor in a very few years. The palm is easily conceded to the copper mines for hoisting engines and even on the iron ranges they are, as a rule, of larger and better types than the other machinery. The object of mining being to raise ore, hoisting engines naturally receive early attention, so that it is not surprising that the number of new installations of late years have been comparatively small. Several water tube boilers of different designs have been put into service at the mines. Mechanical stokers have obtained only a small footing.

The more frequent use of caving systems has decreased the consumption of timber. That is one of the advantages sought. Some systems require a less number of pieces, while others save principally in the size of the timber. To the saving in the cost of the timber must be added the saving in the labor of handling it. Greater judgment has undoubtedly been used also in mines rooming with sets in selecting the size of timber.

Without more data than are at hand it cannot be said whether much or little saving has been made on the whole in the use of explosives by the change of systems. Those plans which tend to crush the ore by excavating from below would seem to be more economical in this record. A tendency to use explosives of higher strength may properly be noted.

When the panic came and the mines curtailed operations there was a surplus of mining material of different kinds which was drawn on until exhausted. Like the stoppage of development work, this "skinning" process could only be for a time and when expansion came again, replacements were all the greater. The reduction in the cost of ore was aided by the reduction in the price of supplies, though not always in the same proportion. Thus, pipe fell 42 per cent, drill steel and castings 30 per cent, timber 25 per cent, coal 23 per cent, powder and cylinder oil each 20 per cent and wire rope 19 per cent. A few mines found economy in substituting wood for coal during the hard times when labor was plenty and stumpage accessible and cheap.

In conclusion it may be said in general, that the first blow of the panic was met by a stoppage of exploring and development work and severe reductions in wages; thereafter, by rigorous economy, the strictest attention to details and the overhauling of methods and, as the outlook brightened and wages advanced again, by labor saving plans and the increase of outputs.

If the proposed consolidation of bridge building companies should be effected and should result in an abatement of some of the practices which have been more or less common in the highway bridge business, the public might gain rather than lose. The results of free competition in highway bridge lettings have been a great expenditure on the salaries and expenses of traveling agents, and not infrequently a competition as to which concern could pay the highest price to buy the favor of the public officials in charge of the letting. It is the taxpayers, not the bridge companies, which have had to pay these bills in the end; and any consolidation which can wipe out these needless expenditures can afford to divide with the public, and still have left a large profit for itself.—[Engineering News.

THE ARNOLD MAGNETIC CLUTCH.

In the design of the modern electric power plant it is frequently found desirable to arrange the generators in such a way that they may be readily connected to or disconnected from the prime movers according to the exigencies of the service. This requirement was early realized by Bion J. Arnold, of Chicago, who recognized at the same time the limitations of the ordinary friction clutch for this purpose. He accordingly worked out a device which would meet modern requirements, and the result has been the development of the Arnold magnetic clutch, a number of which have already been built.

These clutches are friction clutches, yet the friction between the contact surfaces is not due to mechanical pressure, but to magnetic traction. The working parts are composed of metal having a high permeability, so arranged as to become magnetized upon the passage of direct current through the coils with which they are provided. The two parts of the clutch can be attracted together in this way with a pressure greater than that obtained in mechanical clutches, and it is only a question of making the clutches large enough to enable them to transmit power in any desired amount. The energizing circuit is controlled by means of a switch placed at a convenient point, which is quite a decided advantage over the ordinary friction clutch. It thus becomes possible in throwing a generator in or out of service to control it entirely from the switchboard, where all the regulating devices and measuring instruments are within the reach of one attendant. These magnetic clutches also possess the advantages of neat appearance and compact design. Even in the larger sizes the amount of space occupied upon the shaft is not much more than twice the diameter of the shaft, and by using a flange forged solid on the end of the shaft, they can be made to occupy even less space when used as cut-off couplings. Owing to their having no projecting surface or parts to catch the air when in operation the windage resistance is negligable. The greatest advantage, however, of this form of clutch over others is the fact that it is self-contained—the "action and reaction" being within the clutch itself, and consequently there is no resulting end thrust upon the shaft bearings and no additional friction load due to the operation of the clutch.

The illustration, Fig. 1, shows the largest magnetic clutch in the world. It is 100 inches in diameter, and is capable of transmitting 3,000 h. p. at 150 revolutions per minute. This clutch is one of three now in use connecting the engines and generators in the central station of the Imperial Electric Light, Heat & Power Co., at St. Louis, a view of the equipment of which is shown in Fig. 2. The experience with its plant demonstrates that this form of clutch is applicable to the large size units now being installed for power station purposes, whereas the ordinary friction clutch becomes specially unwieldy and unsightly after passing the 500 h. p. size.

It is believed that a clutch of the type shown can be substituted for the fly-wheel of the engine in many cases, thus making the weight and cost of the engine unit, fitted with magnetic clutches, but little more than the weight and cost of the small installation fitted with ordinary mechanical coup

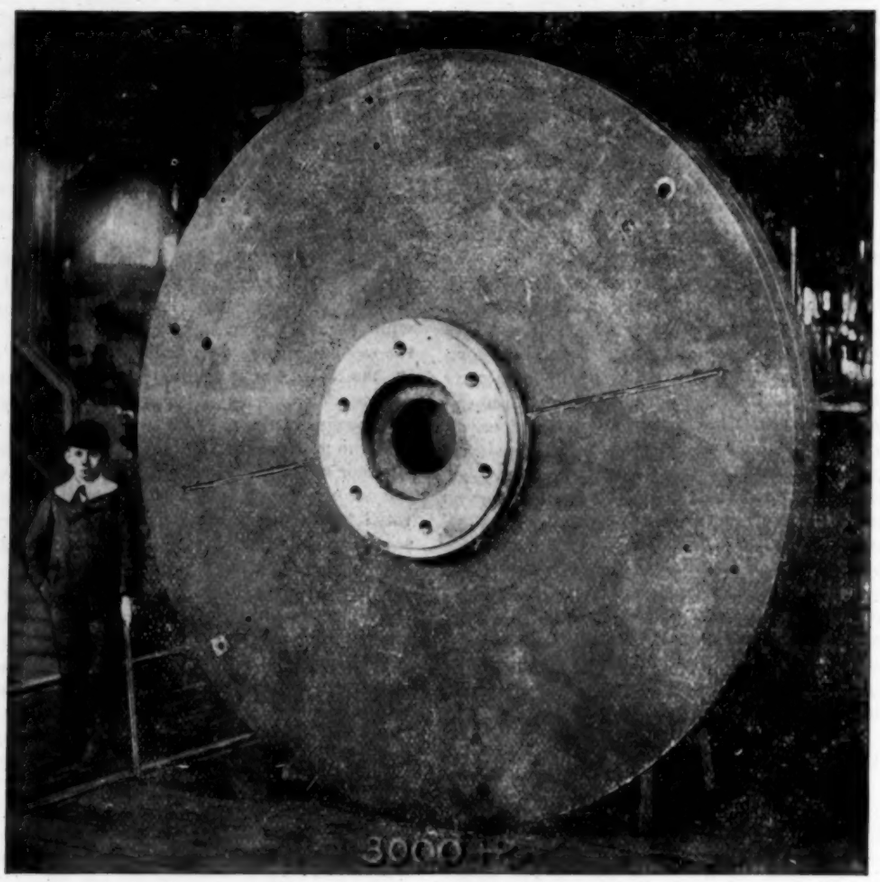


FIG. 1.—LARGEST MAGNETIC CLUTCH IN THE WORLD.

lings. The current is carried to the clutch coils through contact rings upon the side of the clutch, and carbon brushes held by insulated brush holders. The electrical connections are simple and easily accessible for inspection. The unique feature of this clutch is the small amount of current needed. It requires no more than would be used by four 16 power incandescent lamps, and the loss in the clutch due to the continuous use of the electric current, while the clutch is in operation amounts to only one-hundredth of one per cent of the power transmitting capacity.

Although these clutches were developed for use in connection wtih the "Arnold system" of power station construction, they have been adopted for other purposes. A number have been made to connect large synchronous motors to their load in such a way that they can be quickly disconnected in case of accident, and tney have also been built for use upon line shafting. They are considered particularly applicable to use in connection with gas engines. They might eliminate the fly-wheel problem of the gas engine in many cases, which of

itself would be an advantage. The manufacturers intend to push their use wherever it is desired to transmit power from one shaft to another.

LAKE SUPERIOR MINING INSTITUTE.

The sixth annual meeting of the Lake Superior Mining Institute which had Iron Mountain, Mich., as its headquarters, was one of the most successful, probably in many respects the most satisfactory in the history of the organization. The members gathered at Iron Mountain on Tuesday morning, Feb. 6, and at 9 o'clock took a special train on the Chicago & Northwestern railroad for the day's inspection of mines, those first visited being located east of Iron Mountain. The train service was excellently handled, Supt. W. B. Linsley, of the C. & N. W., so well known among the mining companies, being a member of the party, as was also Assistant Superintendent J. M. West, of the Peninsula Division. Among those who went on the excursions and attended the sessions of the Institute were the following:

Geo. A. Newett, W. H. Johnston, Arthur K. Sedgwick, A. J. Yungbluth, Wm. E. McCutcheon, Will E. McKee, Jacob Harper, James Clancy, George R. Jackson, S. R. Elliott, James Stephens, D. Campbell, James H. Rough, J. Tregoning, Alfred Collick, E. J. Butler, T. H. Martin, C. T. Fairbairn and E. J. Butler, Ishpeming, Mich.; Wm. Kelly, Wm. Bond, A. W. Thompson, F. Copeland T. R. Trudgeon and E. Roberts, Vulcan, Mich.; C. E. Porter, Howard Green, Jr., B. W. Goodsell and John Carey, Chicago; George H. Abeel and R. E. Roberts, Hurley, Wis.; Charles E. Lawrence and Charles W. Hughes, Amasa, Mich; President H. C. McNair, of the College of Mines, Graham Pope, A. E. Seaman, and O. P. Hood, Houghton, Mich.; Henry Truscott and Nicholas Henderson, Lorette, Mich.; J. Parke Channing, New York; Samuel F. Miller, Oshkosh, Wis.; H. F. Ellard, R. C. Knight, G. A. Hellberg, William Williams and James B. Knight, Norway, Mich.; O. C. Davidson, E. W. Hopkins, and D. C. Peacock, Commonwealth; A. L. Flewelling, Samuel C. Bennetts, C. T. Roberts, D. B. McDonald, Arvid Bjork, Frank Scadden and H. H. Dyer, Crystal Falls, Mich.; S. T. Beattie and H. D. Fisher, Florence, Wis.; D. T. Morgan, Republic, Mich.; Mark Elliott, Palmer, Mich.; F. W. Denton, Winona, Mich.; J. B. Cooper, South Lake Linden, Mich.; Thomas F. Cole, John H. McLean, Will H. Cole, Geo. Sutherland and E. C. Wall, Ironwood, Mich.; James S. Wall and Geo. L. Woodworth, Iron River, Mich.; Dr. Nelson P. Hulst and Wm. D. Van Dyke, Milwaukee; Walter Fitch, Champion, Mich.; B. O. Pearl, Marquette; Welcome Hyde, Appleton, Wis.; E. F. Sweeney, Virginia, Minn.; C. A. Lawton, Depere, Wis.; H. B. Alexander, Spokane, Wash.; John A. Redfern, Hibbing, Minn. In addition to the above were representatives of the mines of Iron Mountain and vicinity.

Excursions to Mines.

The trip of Tuesday brought the members first to the Cundy mine at Quinnesec, a property of the Illinois Steel Co. The product of the mine, which is a hard ore, somewhat magnetic, is now being shipped by rail from both shafts to the furnaces at South Chicago. A mile south of Quinnesec the visitors were shown the splendid paper and pulp mill the Kimberley & Clark Co. is completing. The magnitude of the equipment attracted the attention of all and brought out much favorable comment. Thus far about $2,500,000 has been expended and it is expected as much more will be put in the enterprise. Power is furnished by a double turbine wheel, the lower Quinnesec falls adjoining the mill, the fall being 65 feet. In the paper mill proper are 24 drying rolls weighing 7,500 pounds each, and steam is supplied to them from a large plant. The main stack of this plant is 179½ feet high and the diameter of the flue is 8¼ feet, that of the stack being 18 feet at the base.

The Aragon mine at Norway, Mich., was visited next. Here the pneumatic haulage plant, recently described in these columns, was the principal feature of interest. The steel shaft house, which is the only one in the region apart from that of the Aurora mine, was also commented upon. The new compressing and hoisting plants were inspected, the latter being furnished by the Webster, Camp & Lane Machine Co., of Akron, O. The Vulcan and East Vulcan mines of the Penn Iron Mining Co. were visited later. The surface tramming plant was a matter of much interest at the Vulcan and it was pronounced the best in the district. The electric bell system was also the subject of favorable comment. The tram cars have eight wheels and are capable of unusually rapid work. The Verona mine, formerly the Southeast Vulcan, recently acquired by Pickands, Mather & Co., was visited, as was also the Loretto, a portion of whose workings are under the Sturgeon river.

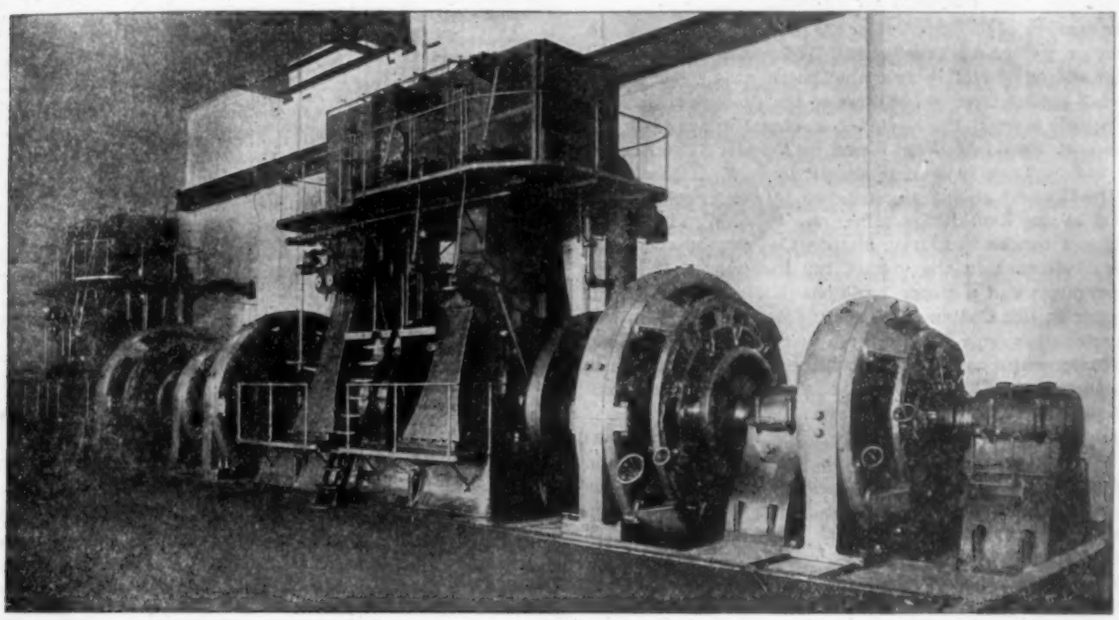


FIG. 2 —VIEW SHOWING POSITION OF CLUTCH ON THE ENGINE SHAFT.

The railroad trip of Wednesday was to the mines in the Crystal Falls and Iron River districts. The Iron River mines are the property of the Oliver Iron Mining Co. The Dober and the Riverton are being extensively worked, and the Isabella and Miller will be wrought later. The Iron river flows over the Riverton and it will be necessary to divert the course of the river. Work is already progressing on this undertaking which necessarily will be an expensive one. The Dober mine presents the same problem. It has a large body of hard ore, the full extent of which is not yet known. A flume ¼ mile long is to be constructed at the Riverton to carry

the water across the location. At the Riverton 30,000 cubic yards of earth must be removed in changing the course of the channel. The Mansfield mine, the next property visited, was of interest because of the terrible calamity of Aug. 23, 1893, when the Michigamme river broke into the mine and drowned 28 men. The course of the river was changed after the accident and the mine reopened. A new hoist and new compressor are to be installed. The product is largely Bessemer ore while all other mines in the district yield non-Bessemer ore. The afternoon of Wednesday was spent in looking over the mines in and about Crystal Falls, the principal ones being the Crystal Falls, Great Western, Lincoln, Monitor and Bristol. The last mine, formerly the Claire, is being operated by a company controlled by Oglebay, Norton & Co. The open pit plan was adopted. Considerable stripping was done and the ore will be milled to a drift at the bottom of the open pit, sent to the shaft and hoisted. A Gates crusher will be put in, the product being hard ore.

The excursion of Thursday took in the mines at Iron Mountain—the Pewabic, the Millie and the great Chapin. In drifting at the Chapin great bodies of water have been encountered in the past year and these have formed one of the most difficult problems with which the management has had to deal.

Sessions for Papers.

The sessions of the institute for the reading and discussions of papers were held Tuesday and Wednesday evenings, the former at Iron Mountain and the latter at Crystal Falls. We shall publish later two or three of the prominent papers, having only space in this issue for a liberal synopsis of the address of President Wm. Kelly, of Vulcan. There were also read on Tuesday evening a paper by L. M. Hardenburg, on "Ore Concentration," as carried on by the Pewabic Mining Co. at the Keel Ridge mine; one by A. W. Thompson, electrician for the Penn Iron Mining Co., on the system of electric bells seen in the visit of the institute to the West Vulcan mine; and a paper by James McNaughton, general manager at the Chapin mine, on "Mine Dams." Mr. McNaughton gave some details of the methods adopted to hold back water which had been encountered in great quantities in drifting in the Chapin mine and in making the cross-cut from the Chapin to the Hamilton.

The papers of Wednesday evening were as follows: "Economy in Cost of Mining Machinery," by Chas. H. Fitch, of Fraser & Chalmers, Chicago; "Method of Mining at the Badger Mine, Commonwealth, Wis.," by O. C. Davidson. President Kelley presented a model showing the method of operating bailers in balance at the West Vulcan mine. Tandem drums are employed and it has been found feasible to have one man operate both drums. A reduction in cost, as against the employment of pumps, was realized. As seen at the West Vulcan mine, this apparatus was one of the most interesting features in the three days of excursions, and the discussion of the topic was very generally participated in. In the discussion of Mr. Fitch's paper the opinion was expressed that hoisting engines should not be standardized, owing to the varying conditions as to capacity of skips, size of loads, depth of mines, etc.

In the business session of the institute an invitation was presented from Milwaukee to have the next meeting in that city. In all 54 new members were elected at the two sessions. The following officers were elected: President, Graham Pope, of Houghton; vice-presidents—O. C. Davidson, Commonwealth; T. F. Cole, Duluth; J. H. McLean, Ironwood; M. M. Duncan, Ishpeming; F. W. Denton, Winona; board of managers—E. F. Brown, Iron Mountain; Ewin Ball, Tower; Geo. H. Abeel, Hurley; Walter Fitch, Beacon; James B. Cooper, South Lake Linden; secretary, F. W. Sperr, Houghton; treasurer, A. J. Yungbluth, Ishpeming. A banquet at Iron Mountain Thursday evening brought to an end one of the most profitable and withal one of the pleasantest meetings in the history of the institute.

New Publications.

A valuable monograph entitled "Condensers" has been issued by the Power Publishing Co., of New York. It is a reprint of lectures and articles on this subject from the columns of *Power*, by the editor F. R. Low. The only thing that we would have stricken from the book is the leaf devoted to "errata." The price is 50 cents.

From the American Artisan Press, Chicago, we have the "Cornice Work Manual," a 12mo. of over 200 pages, the matter for which was compiled from the *American Artisan*. It is the only work of this character that has appeared in a number of years, and with its illustrations and detailed instructions will prove of value to those engaged in the working of sheet metal.

OUTPUT OF BLAST FURNACES OF UNITED STATES.*

February 1, 1900.

Location of Furnaces.	Coke and Anthracite.					Charcoal.				
		In Blast.		Out of Blast.			In Blast.		Out of Blast.	
	Total No. of Stacks.	Number.	Weekly capacity.	Number.	Weekly capacity.	Total No. of Stacks.	Number.	Weekly capacity.	Number.	Weekly capacity.
New York	13	6	6992	7	3650	2	2	195	0	0
New Jersey	7	5	3461	2	1200	.....	.....	.....	.....	.....
Spiegel	2	2	450	0	0	.....	.....	.....	.....	.....
Pennsylvania:						13	2	120	11	559
Lehigh Valley	27	23	11941	4	1335	.....	.....	.....	.....	.....
Spiegel	1	1	110	0	0	.....	.....	.....	.....	.....
Schuylkill Valley	15	10	7154	5	3492	.....	.....	.....	.....	.....
Upper Susqu. Val.	5	3	2261	2	1550	.....	.....	.....	.....	.....
Lower Susqu. Val.	10	10	6319	0	0	.....	.....	.....	.....	.....
Lebanon Valley	13	11	8294	2	934	.....	.....	.....	.....	.....
Pittsburgh	29	29	61671	0	0	.....	.....	.....	.....	.....
Spiegel	1	1	3080	0	0	.....	.....	.....	.....	.....
Shenango Valley	15	15	20849	0	0	.....	.....	.....	.....	.....
West'n Pennsylvania	18	15	19276	3	1940	.....	.....	.....	.....	.....
Spiegel	1	1	1088	0	0	.....	.....	.....	.....	.....
Maryland	4	3	5804	1	170	4	1	120	3	440
Spiegel	1	1	520	0	5	.....	.....	.....	.....	.....
Wheeling District	10	10	13134	0	0	.....	.....	.....	.....	.....
Ohio:						8	2	165	6	395
Mahoning Valley	14	12	18736	2	2000	.....	.....	.....	.....	.....
Central & Northern	11	11	16439	0	0	.....	.....	.....	.....	.....
Hocking Valley	2	2	950	0	0	.....	.....	.....	.....	.....
Hanging Rock	12	11	5155	1	130	.....	.....	.....	.....	.....
Illinois	16	15	28747	1	1200	.....	.....	.....	.....	.....
Spiegel	1	1	916	0	0	.....	.....	.....	.....	.....
Minnesota	1	1	500	0	0	.....	.....	.....	.....	.....
Wisconsin	4	3	2467	1	1000	.....	.....	.....	.....	.....
Missouri	2	1	875	1	850	.....	.....	.....	.....	.....
Colorado	2	1	1150	1	1000	.....	.....	.....	.....	.....
Virginia	21	17	10335	5	2278	4	1	48	3	290
Kentucky	5	4	1670	1	650	3	0	0	3	200
Alabama	37	27	22221	10	6600	7	4	1252	3	240
Mich., Mo. and Wis.	.....	.....	.....	.....	.....	16	10	4145	6	2668
Tennessee	13	11	6870	2	800	6	4	835	2	200
Georgia	1	0	0	1	500	2	2	612	0	0
North Carolina	2	1	175	1	352	.....	.....	.....	.....	.....
New England	.....	.....	.....	.....	.....	11	3	262	8	730
Texas	.....	.....	.....	.....	.....	4	1	150	3	740
Utah	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oregon	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	316	264	290010	52	31626	80	32	8004	48	6473

SUMMARY.

Fuel.	In Blast. Number.			In Blast. Weekly Capacity.			Out of Blast. Number.		Out of Blast. Weekly Capacity.	
		Month Previous.	Year Previous.		Month Previous.	Year Previous.		Month Previous.		Month Previous.
Charcoal	32	30	17	8,004	7,457	4,967	48	53	6,473	7,553
Coke and Anthracite	264	250	178	290,010	286,729	232,672	52	69	31,626	40,261
Total	296	280	195	298,014	294,186	237,639	100	122	38,099	47,814

*Condensed from the *Iron Age*.

The annual meeting of the American Ax & Tool Co. was held at Pittsburg last week. A net profit of slightly over $100,000 was shown for the year. President Charles W. Hubbard, Jr., of New York, presented the financial report. The directors and officers were reelected. The company is said to be negotiating for the purchase of about 100 acres of land on the Ohio river, a mile below Steubenville, O. Should the land be purchased all the plants will be centralized on this tract. There are 16 plants scattered through the east.

A charter has been granted the Eureka Iron & Steel Mfg. Co., Pittsburg, capital $25,000. The directors are Henry B. Hoarlander, of Blairsville; James H. McCrady and Edward J. Small, of Braddock; Benjamin H. Taylor, of Wilkinsburg; Peter J. Edwards, James E. Rodgers and Robert C. Duncan, of Pittsburg.

THE NEW SHELBY STEEL TUBE CO.

The Shelby Steel Tube Co., with general offices in Cleveland and capital stock of $7,376,400, formed in 1897 by the consolidation of the seamless tube companies of the Central West, has been reorganized in the past week as a New Jersey corporation under the same name. The authorized capital stock is $15,000,000—$6,000,000 preferred and $9,000,000 common stock. The stockholders of that company are to receive in preferred stock in the new company for each share of stock held in the old company one-half of one share of preferred stock and three-fourths of one share of common stock. The rest of the preferred stock, with an equal amount of common stock, was distributed among capitalists. Frank O. Lowden, of Chicago, who had charge of the reorganization, says that its object is to distribute some of the stock among influential people who will help to extend the business of the company, and to have the stock so widely distributed that it may more readily have a market value.

The directors include R. L. Coleman, president of the American Bicycle Co. and A. A. Pope and H. A. Lozier, who are directors of that company. The other directors are: W. E. Miller, Cleveland; B. J. Williams, Shelby, O.; E. W. Bliss, Brooklyn, N. Y.; L. S. Hoyt, New Castle, Pa.; John L. McKinney, Titusville, Pa.; F. J. Carolan, San Francisco, Cal.; Frank O. Lowden, Chicago; James B. Dill, East Orange, N. J. It is expected that the officers of the old company will take charge of the new company. They are: President, W. E. Miller; treasurer, W. S. Miller; secretary, H. H. Cockley; N. A. Gilbert will be general counsel. The stock, it is expected, will be listed on the Chicago Stock Exchange.

In his prospectus Mr. Lowden says the business is the manufacture of seamless steel tubes. The company is enabled to take a solid steel billet and draw it into a hollow seamless tube of any shape and dimensions up to four inches in diameter. "The government requires this form of tubing in all its marine construction, the railroads are using it largely and increasingly for locomotive boiler tubing, it is essential in bicycles, and is used in many other forms. There is no conflict, as I understand it, between the product of this company and the product of the National Tube Co. The business proved profitable from the first and has steadily grown until the assets of the new Shelby Steel Co. will be in excess of $5,350,000. This does not include good will nor the patents and secret processes, though the owners of these plants believe that their patents and a number of their secret processes are the most valuable assets. The Shelby company during the five years preceding June 1, 1899, earned $1,786,764, or an average a year of $357,334. But $5,000,000 of preferred stock will be issued, and but $8,150,000 of common stock."

The companies and plants included in the new Shelby Steel Tube Co. are the following: New Castle Tube Co. McCool Tube Co. Auburn Nut & Bolt Works. Hercules Seamless Tube Co. The Pope Tube Co., absorbed in 1899. The tubing end of the business of the United States Projectile Co. Ellwood Weldless Tube Co. Greenville Tube Co. American Weldless Tubing Co., of Toledo. Brewer Seamless Tubing Co., of Toledo. United States Standard Drawn Steel Co., Cuyahoga Falls, O. The Shelby Steel Tube Co., of Ohio. The Albany Mfg. Co., of Albany, Ind., absorbed in 1899. The tubing end of the business of the Mansfield Machine Works.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Newton Machine Tool Co., of Philadelphia, will be in the market shortly for a vertical boiler.

The Anderson Malleable Iron & Mfg. Works, of Anderson, Ind., have been incorporated with capital stock of $75,000. Dirctors—John L. Forkner, Maurice S. Howe, J. B. Latchem, James and C. W. Beeker.

The Shelby Machine & Foundry Co., of Shelby, O., has been incorporated with $10,000 capital.

The Peoria Mfg. & Supply Co., has been incorporated at Peoria, Ill., with a capital stock of $20,000, for manufacturing goods, by Charles W. O'Neill, William Murphy and Wm. G. McRoberts.

The Ewald Brown Hicks Rolling Mill Co., of St. Louis, capital stock $75,000, has been incorporated by J. H. Ewald, Benjamin Brown, George B. Hicks, Jr., and others.

W. H. Robertson Steel & Iron Co., Cincinnati, contemplates the manufacture of small rivets and is in the market for 10 first class rivet machines, several wire drawing benches and other equipment.

Fires and Accidents:—

The buildings at Detroit formerly occupied by the Detroit Malleable Iron Co. and now being refitted for the Michigan Malleable Iron Co., of Delray, were damaged by fire to the extent of nearly $30,000.

Fire in Hoboken, N. J., destroyed the Elysian Machine shops, the brass foundry of W. & A. Fletcher & Co. and the plant of the Zenith Mfg. Co. Loss $80,000.

The coke-crushing plant of the St. Clair Coal & Coke Works, at St. Clair, Fayette Co., W. Va., was destroyed by fire. Loss $12,000, insured for $4,000.

The machine shop of Sprout, Waldron & Co., of Muncy, Pa., was destroyed by fire Feb. 7. The loss is about $80,000, with an insurance of $36,000.

New Construction:—

A nw machine shop for the Pennsylvania Steel Co.'s plant at Steelton, Pa., is under way.

It is expected that the government will erect a steel plant at the arsenal at Watertown, Mass.

The Marion Steam Shovel Co., Marion, O., which is now running day and night, is reported to contemplate additional building in the spring, to accommodate more men.

The Marion Malleable Iron Co., Marion, O., added to its plant recently and increased its force by 120 men.

The Baldwin Locomotive Works will soon make additions to their machine shops, costing $125,000.

At Philadelphia, Macey, Henderson & Co. are receiving bids for the erection of a brick foundry and vault for the De Kosenko Mfg. Co.

The buildings of the new Grand Rapids (Mich.) Malleable Iron Works are expected to be ready for operations early in March.

Articles incorporating the Clinton Burnham Foundry Co., of Milwaukee, has been filed by Clinton Burnham, Carroll M. Towne and George Lines. The company will manufacture iron products and has a capital of $55,000.

The Newton Machine Tool Co., of Philadelphia, will have plans and specifications ready about Feb. 15 for a three-story building adjoining the present structure. The addition will give the company floor space 250x100 feet and about three times the present capacity. They will want a vertical boiler later.

The Frankford Steel & Forging Co., of Philadelphia, with works at Ellwood City, Pa., is enlarging its plant which will have floor space of about 4,200 square feet. It is also adding large tools for machine forgings.

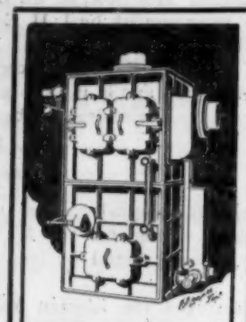
The Pittsburg District:—

H. H. McClintic, formerly manager and vice-president of the Schiffler Bridge Co., and Charles D. Marshall, formerly secretary and engineer for the same company, have opened an office in the Park Building, Pittsburg, under the name of the McClintic-Marshall Construction Co. It is said that a company will shortly be incorporated under the above name.

The bursting of a 60-ton fly-wheel in the blooming mill of Howe, Brown & Co., Pittsburg, last week, caused damage to the extent of $1,000.

Park Bros. & Co., operating the Park Steel Co., Pittsburg, have purchased 100 acres of ground at Jones and Elwyn stations, south of West Elizabeth, Pa. A month ago it was announced that Park Bros. & Co., had purchased more than 200 acres in this vicinity for upwards of $200,000. The last purchase cost about $75,000. It is denied that the plant of the Park Steel Co. will be removed to these new holdings, however.

It has been decided by the officials of the American Steel & Wire Co. to install their recently ordered Uehling casting machine on Neville Island. When the contract was let the



COCHRANE HEATER

COCHRANE FEED-WATER HEATERS

Additional Economy, or More Steam.

It is within the province of a properly designed feed-water heater to effect economies or increases of power so considerable that the cost of one of these appliances represents only a small proportion of the savings made during a single year's run. The saving or the earning capacity of a heater is something positive and tangible; something which can be computed or measured. No matter how economical the engines are in developing power—no matter that the boilers are of the most efficient type for transmitting heat from the fuel to the water—a feed-water heater will improve the plant, and still further decrease the coal consumption.

Four tons of coal can frequently be made to do the work of five tons, without a single change in the engines or boilers, or in the way of running them; nine tons of coal can be made to accomplish nearly as much as ten tons, even in a plant where everything is run condensing. The factors in each case are the same, i. e.,

Exhaust Steam—COCHRANE Feed-Water Heaters—and Brains—

the latter being only the common-sense adaptation of the means at hand to meet the requirements.

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machine was to have been built at the Edith furnace in Allegheny. The removal of this furnace to Neville Island necessitates the erection of the casting machine in the same place.

During the past few months the American Steel & Wire Co. has acquired one tract of land after another on Neville island, below Pittsburg, until it has acquired 182 acres in all. The cost of the land is estimated at nearly $400,000. Upon this island the plants of this company in the Pittsburg district will shortly be concentrated. It is considered one of the finest manufacturing sites in the Pittsburg district.

Davis & Young, Pittsburg, have contracted with the Dominion Iron & Steel Co., Sydney, Cape Breton, for the construction of 400 Otto-Hoffman coke ovens. Forty workmen were sent from Braddock, Pa., last week, to do the work.

The W. Dewees Wood Co., McKeesport, Pa., will shortly erect an addition to its plant on a recently purchased tract near Charleroi, fronting on the Monongahela river. The extension is made necessary by steadily increasing orders.

The Monongahela and Star tin plants of the American Tin Plate Co., located in Pittsburg, will resume operations in a week or ten days. Both plants were closed down several months ago. The Monongahela is a 14-mill plant having a capacity of about 250,000 pounds of tin plate in 24 hours. Work has already been commenced upon the new cold mills that are to be installed in this plant. The Star is an 8-mill plant.

The Westinghouse Electric & Mfg. Co. has asked for bids for the construction of another large building at East Pittsburg that has been made necessary by the great increase in the business of this company. The building will be erected to the east of the present buildings and will be so connected with them by railroads that the handling of heavy material will be comparatively easy. The structure will have a total length of 540 feet and will consist of three bays that will give a total width of 327 feet. It will be of steel frame construction with heavy columns and piers. Eight electric cranes will travel the entire length of the building and auxiliary cranes will be used to transfer from one track to another.

The Riter-Conley Co., Pittsburg, has been awarded the contract for the construction of a forge shop for the Reading Iron Co., to be 300 feet long and 100 feet wide. The work of preparing the material has already commenced. The final shipment of material for the San Paulo Electric Light & Power Co.'s plant, Brazil, was forwarded last week by this company.

The Pittsburg Reduction Co. has let the contract for the erection of another plant for the manufacture of aluminum on the Canadian side of the Niagara river.

The Leechburg Foundry & Machine Co. surrendered its charter in the Allegheny county courts last week and legally wound up its affairs. The company began business in Leechburg, Pa., in 1874. The office of the company was in Pittsburg. Last summer the business was taken over by the Mesta Machine Co., and all the machinery and equipment in the Leechburg plant was removed to the plant of the Mesta Machine Co.

Mackintosh, Hemphill & Co. are installing two pair of reversing engines for the Carnegie Steel Co., one at Homestead and the other at Duquesne. They are 55x60 geared. They are also erecting one 40-inch blooming mill for the company at Duquesne. The Cambria Steel Co., Johnstown, will install two pairs of direct reversing engines, 55x60 geared, and one 40-inch blooming mill from the same company.

The Pressed Steel Car Co., Pittsburg, is working on a trial order of a specially designed steel hopper car for the Furness Railway, Lancashire, Eng. The cars are to be of 100,000 tons capacity and are to be used in the transportation of coal and ore from the Lancashire mines to iron and steel plants. The use of the steel hopper car will necessitate the adoption by the English steel companies of the American methods of unloading raw material. An order has also been received from the Philadelphia & Reading Railroad Co. for 500 box cars, 60,000 pounds capacity. The cars are of an entirely new type and have the Schoen steel underframe and will be equipped with Fox trucks. Their length over all will be 36 feet.

The Phillips Mine Supply Co., Pittsburg, will shortly let the contract for the erection of a foundry. This will mean a big addition to its present plant.

W. F. Trimble & Sons, Allegheny, were awarded the contract for the erection of the extensive addition to the Westinghouse Co.'s plant at East Pittsburg. The addition is to be 1,200 feet long and 115 feet wide. The work is to be completed in four months.

Chicago District and Northwest:—

The Streeter Brake Shoe Co. has been incorporated in Chicago, with a capital stock of $50,000, to manufacture and deal in metal castings. The incorporators are Alfred L. Streeter, John H. Logeman and Wesley B. Cross.

The Durst Mfg. Co., Chicago, has been incorporated with

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a capital stock of $5,000, for manufacturing machinery. The incorporators are Philip E. Durst, William K. Otis and Lynn R. Rutter.

The capital stock of the Sargent Co., Chicago, manufacturer of steel and iron castings and brake shoes, has been increased from $350,000 to $500,000.

The B. Hoffman Mfg. Co., of Milwaukee, has increased its capital stock from $75,000 to $150,000. Iron and brass foundries are operated and steam and gas fittings are manufactured.

The Chicago Malleable Casting Co.'s new plant at 120th st. and Center ave., whose buildings under one roof are 500x380 feet, has been started successfully. At present 230 men are at work and the force will be increased to nearly 400. Large orders for the Pland Mfg. Co. are on hand. The officers are: W. H. Jones, president; S. J. Llewellyn, vice-president; J. T. Llewellyn, treasurer and general manager; E. H. Llewellyn, secretary; R. S. Smith, superintendent.

The Milwaukee Steel Casting Co., Greenfield ave. and Clinton st., Milwaukee, Wis., has almost quadrupled the size of its plant in the past year. The plant now covers a ground space of 150x250 feet, and has a capacity of from 12 to 15 tons of light and heavy castings, ranging from an ounce to eight tons. At the present time the company is making about eight tons of castings a day. The company controls the Tropenas process for making steel castings for Wisconsin, and has two Tropenas converters in its plant. It makes a specialty of magnetic steel and tool steel, and has a considerable business in manufacturing steel castings for dynamos, armatures and other electrical machinery. It now has orders ahead for the next 60 days.

J. & G. Obenberger, manufacturers of ore and coal handling machinery and forgings at 123 to 127 Barclay st., Milwaukee, Wis., report a good demand for their products, and that their plant is now running almost full. Among the specialties manufactured by the firm are automatic coal tubs and buckets, iron ore buckets, clam shell buckets and hoisting carriages.

The Minerva Pig Iron Co., operating the Minerva blast furnace, at Milwaukee, Wis., has had an excellent demand for its pig iron. The company has sold most of its product for the first six months of this year, but has a small quantity of iron which it can deliver at that time. Plans are in progress for considerable additions to the plant, which will about double its capacity, but until there is some slackening up in the demand for iron it will not be possible for the extensions to be made.

The business of the Carborundum Co. is reported to be very satisfactory in the territory tributary to Chicago, the Western representative being Ed. J. Eames, 65 S. Canal st. A very general use of Carborundum wheels in foundries has resulted from the efforts of the Western house, and their increasing employment in tool and general machine shop work is reported. A largely increased business in 1900 is looked for. The recent move to Canal st., and the carrying of stock, the range of which is being steadily increased, have proved advantageous.

General Industrial Notes:—

The Whitaker Iron Co. and the Wheeling Corrugating Co. of Wheeling, W. Va., have been combined. The stock of the Corrugating Co. has been increased from $150,000 to $5,000,000.

The Standard Steel Range & Mfg. Co., Cleveland, has purchased the buildings formerly occupied by the Aurora Vapor Stove Co. They have an area of 75,000 square feet of floor space, and will be used to extend the operations of the purchasing company.

In the comparatively short time the Perfect Lubricating Metal Co., of Cincinnati, has been engaged in the making of

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lubricating metal it has met with such success that its business for 1899 is double that of the previous year. In addition to a good home trade it has had a large export demand, amounting to upwards of three-fifths of the total volume of the year's business. The company has greatly enlarged its facilities and is able now to make prompt shipments. In the export trade shipments of car load lots have been made to England, France and Finland, and quite large quantities to other points in foreign lands. Indications point to a much larger business this year.

The old Briggs Rolling Mill Co. plant at Findlay, O., is being put in shape for operation.

The Harrisburg Foundry & Machine Works of Harrisburg, Pa., have booked a number of orders recently and are operating both the new and old plants day and night. The orders on hand will keep the plant busy until fall.

Articles of incorporation reorganizing the Morgan Engineering Co., of Alliance, O., have been filed by Wm Henry Morgan, Willis H. Ramsey, Mrs. Maggie Ramsey, Annette Sharer Morgan and Edward N. Huggins. The capitalization is $3,00,0000. The company will manufacture steam, hydraulic, electric pneumatic, gas and power machinery, including guns and munitions of war.

The annual election and stockholders' meeting of the Cleveland (O) Punch & Shear Works Co. was held last week. The directors chosen are: W. D. Sayle, J. H. Farley, H. Fuller C. E. Thomas and A. L. Assmus. The officers are: W. D. Sayle, president; H. Fuller, vice-president; C. E.

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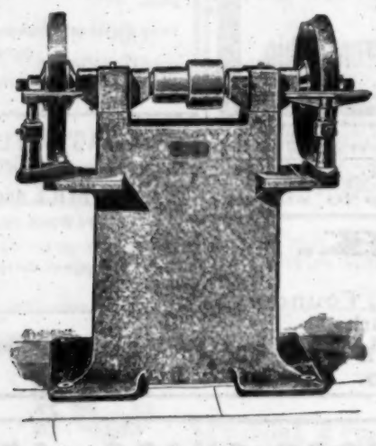

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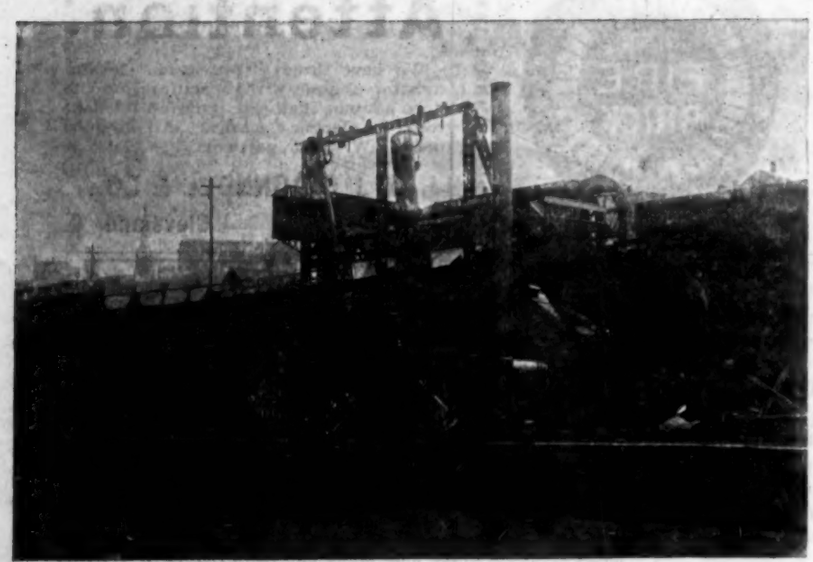

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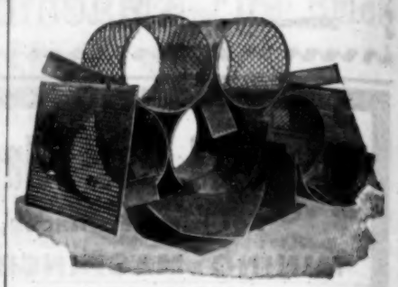

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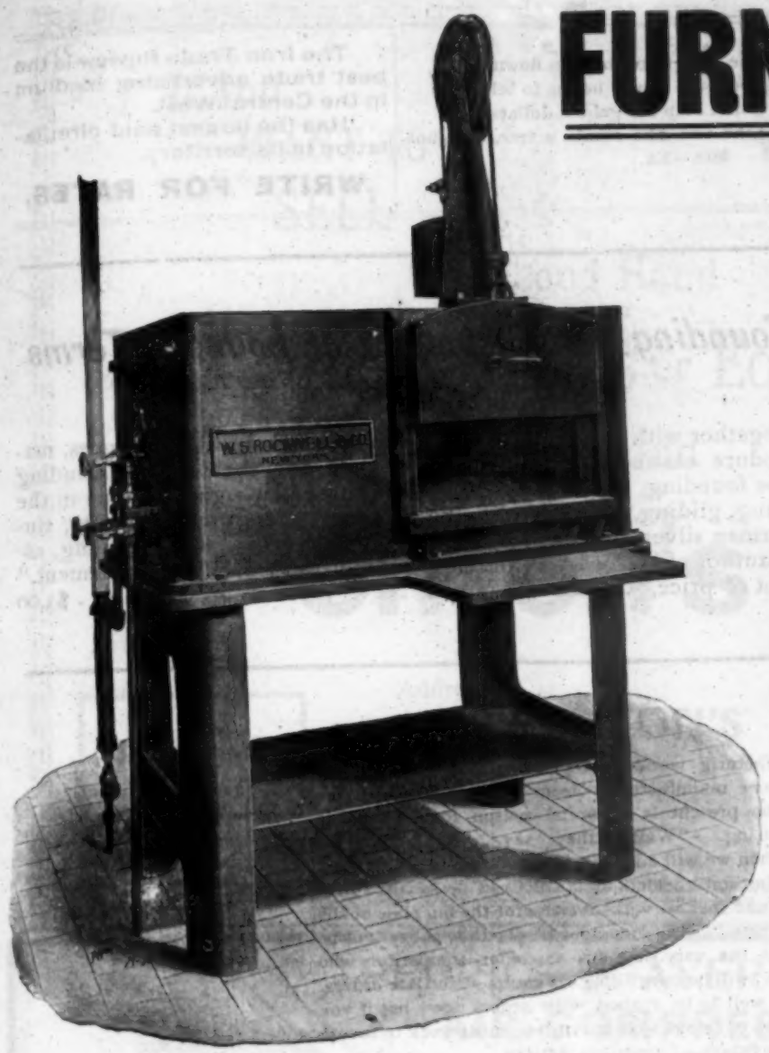

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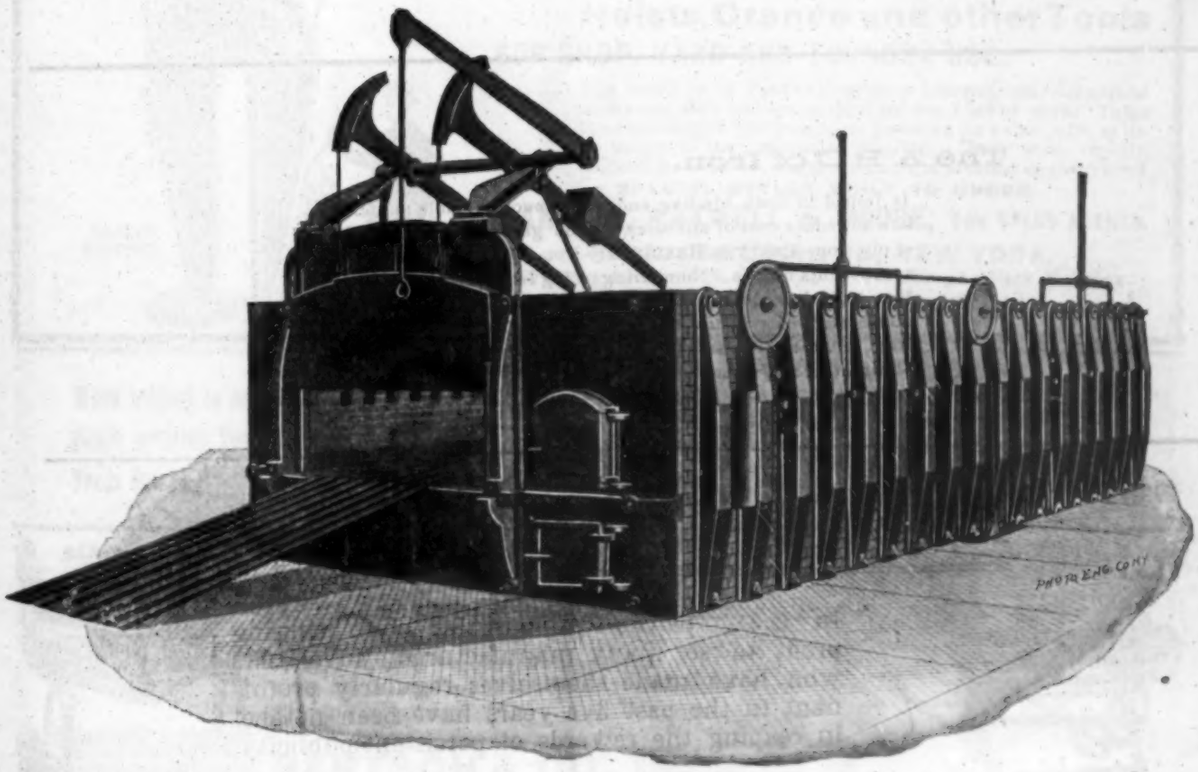

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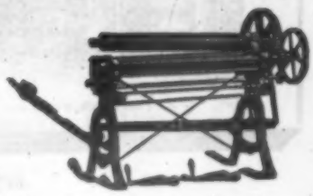

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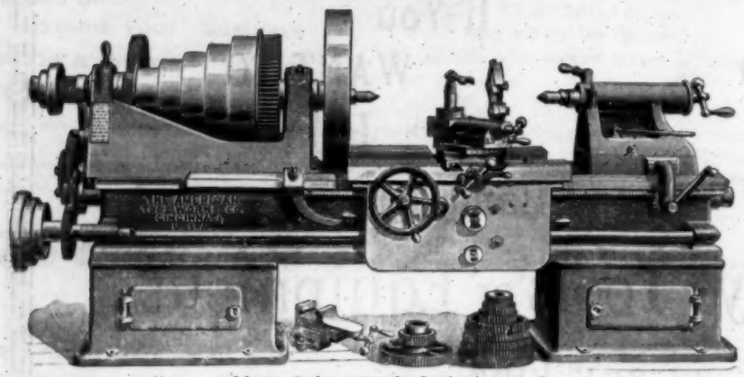

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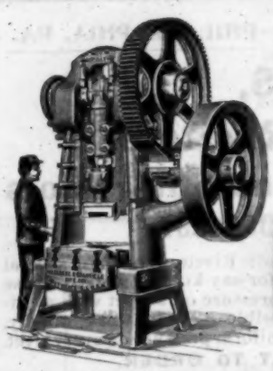

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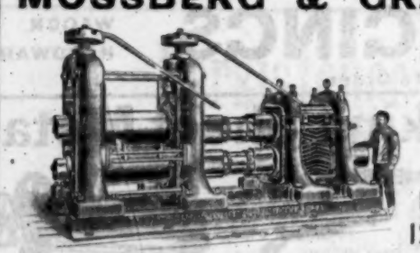

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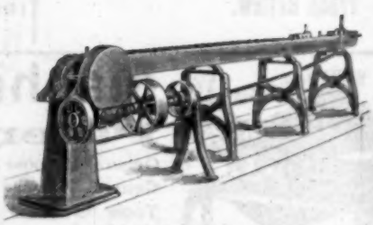

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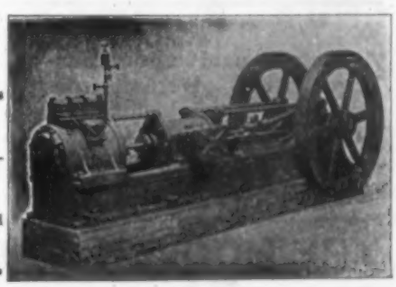

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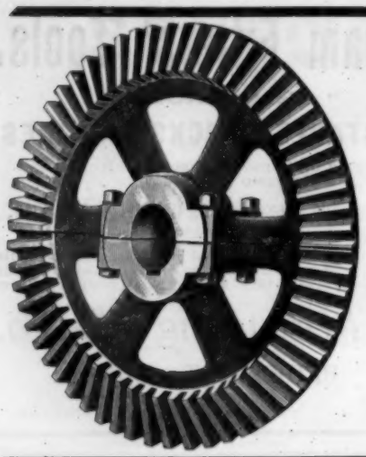

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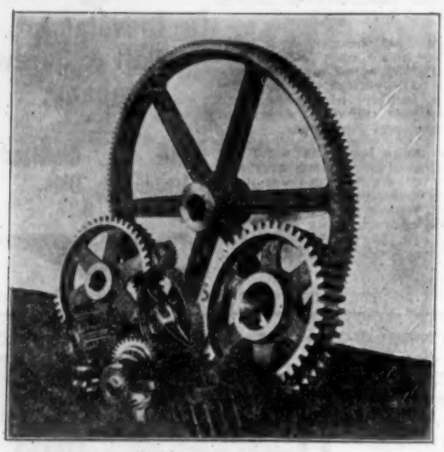

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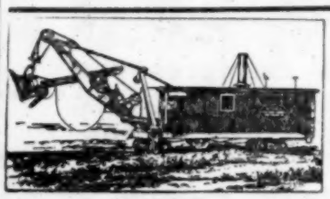

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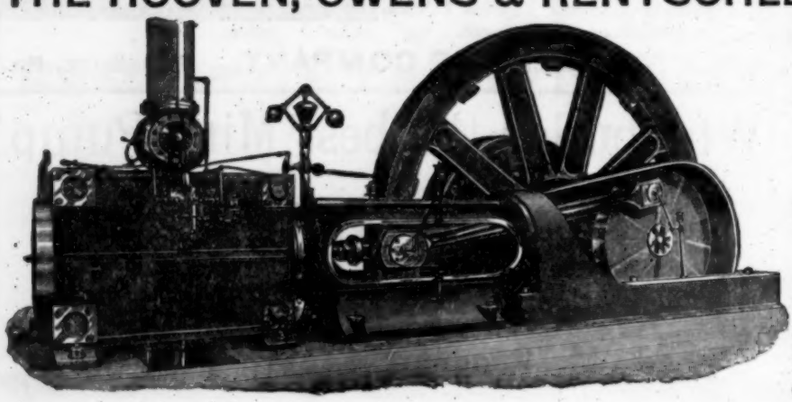

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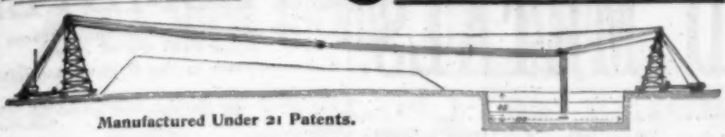

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OF THE
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Will be sent postpaid by *The Iron Trade Review* at $7. Ready now.

Is a thorough revision of the list of blast furnaces, rolling mills, Bessemer and Open-Hearth steel works, plate and sheet mills, nail mills, tin plate mills, malleable, cast iron pipe and wrought pipe works, car wheel and locomotive works, with many new lists of works in other lines.

SECOND EDITION
CREMER & BICKNELL'S
Chemical and Metallurgical
HANDBOOK

EXTRACT FROM PREFACE:

In the preparation of the second edition of our Handbook, the general plan of the first edition has been followed, viz., to present in concise form such data and information as are useful to the chemist and metallurgist. Several tables of the first edition, which were of somewhat limited use, have been omitted, while more than one hundred pages of new matter have been added.

The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognised at present than heretofore. This table is new and is based on the most accurate data available at the present time.

The tables of weights and measures, United States and foreign, have been very much amplified, and the conversion tables for United States and metric weight and measures of the U. S. Coast and Geodetic Survey included, the latter being based on the legal standard for this country.

Numerous miscellaneous tables have been added, which, it is hoped, will be found of value

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Carnegie Steel Company, Ltd., Edgar Thompson	9	3,500	Six.
Carnegie Steel Company, Ltd., Rankin (Carrie)	2	700	Double.
Carnegie Steel Company, Ltd., Pittsburg (Lucy)	2	800	Double.
Struthers Furnace Company, Struthers, O.	1	300	Single.
Laughlin & Co., Ltd., Pittsburg, Pa. (Eliza)	5	2,000	Double (2).
Oliver & Snyder Steel Company, Pittsburg, Pa. (Edith)	1	400	Double.
Oliver & Snyder Steel Company, New Castle, Pa. (Rosena)	1	500	Double.
Shenango Valley Steel Company, New Castle, Pa.	2	800	Double.
Bellaire Steel Company, Bellaire, O.	2	700	Double.
Lebanon Furnaces, Lebanon, O.	2	500	Double.
Tennessee Coal, Iron & Railroad Company, Ensley, Ala.	4	800	Double.
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American Steel & Wire Co.	7	3,000	Double (3).
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is covered by U. S. patents Nos. 548,146, 629,480 and 632,031, which are fundamental, and others are pending.

The use of the Uehling Method at the furnaces mentioned has shown reduced labor cost, while SANDLESS IRON has proved a great advantage to the consumer.

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High Carbon Steel Wires woven together so as to provide amply for expansion and contraction.

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Iron and Steel Wire Rope for all purposes.
Galvanized Guy Ropes.
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Cold-drawn Steel Shafting, any size, highest quality, lathe-cut or saw-cut ends, guaranteed perfect. Rounds, Squares, Hexagons, Flats or odd shapes.

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Common, Refined, and B.B. Iron,	Bessemer and Open Hearth,	and Angles, Turnbuckles, "T" Rails, 8 to 20 lbs., Cold Rolled Steel, Cut Nails,
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For our subscribers and advertisers only, we will insert under this head advertisements of help wanted and situations wanted free of charge. The advertisements to be inserted in three consecutive issues and to consist of not more than six lines each. All other advertisements will be charged at regular card rates.

Wanted—To correspond with a live pushing man who is capable of superintending the manufacture of plows and other implements. State experience, where employed and give references. Opportunity, care IRON TRADE REVIEW.

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Wanted—A first class salesman, one who has had large experience in bar iron and bar steel. Salesman, care IRON TRADE REVIEW.

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Wanted—Ten machine and floor men; also ten molders. Only steady men need apply. The Lloyd Booth Co., Youngstown, O.

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Through the rapid growth and constantly increasing demand for space of the other departments of our business, we are compelled to offer for sale our gas and gasoline engine business.

We sold during the past calendar year over 125 engines, averaging between 10 and 20 H. P., and ranging in size from 3 H. P. to 50 H. P.

Included in our offer are all drawings patterns, patents, jigs, templates, special tools, finished and unfinished stock, and also about 60 engines ready for immediate delivery.

The business is thoroughly organized and can be continued without interruption. Parties having the necessary capital will be offered the fullest opportunity for investigation upon satisfactory proof of their sincerity.

Address all replies to "E. E. S.," Care of IRON TRADE REVIEW.

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1 Mundy 7 x 12 single cylinder, single drum Hoisting engine, with boiler.
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Two Vertical Blast Furnace Blowing Engines, 36 in. x 72 in. x 34 in. and 40 in. x 80 in. x 84 in. Apply for particulars

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2000 Tons in Stock.

Eye Beams, 4 inch to 20 inch, inclusive.
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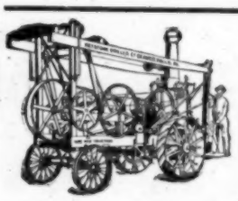

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300 tons practically new 40-lb. Iron Rails with angle splices, in Pennsylvania, subject to Hunt's inspection.

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DIRECTORY

To the Iron and Steel Works of the United States for 1898.

PUBLISHED BY
THE AMERICAN IRON AND STEEL ASSOCIATION.

Thoroughly Revised. Price, Seven Dollars.

In the edition for 1896 there was given for the first time a complete list of Malleable Iron Works in the United States, and to this new feature there are now added complete lists of the Rail Mills, Structural Mills, Steel Casting Works, Bolt, Nut and Rivet Works, Chain Works, Seamless Tube Works, and Riveted Pipe Works—all new features.

The lists of Plate and Sheet Mills and of Tin Plate and Stamping Works are much more complete than in previous editions. The names and location of all the works described are given in alphabetical order, followed by a description of their character, capacity and products, with the names of the principal officers, etc., including the names of selling agents. This edition makes a cloth-bound book of nearly 400 well-printed pages—many more than in any previous edition It contains a complete list of all the

Blast Furnaces,
Rolling Mills,
Bessemer Steel Works,
Open-Hearth Steel Works,
Crucible Steel Works,
Plate and Sheet Mills,
Rail Mills,
Structural Mills,
Steel Casting Works,
Cut-Nail Works,
Tin Plate Works,
Stamping Works,
Forges and Bloomaries,
Wire Rod and Wire Mills,
Wire Nail Works,
Iron and Steel Bridge Builders,
Iron and Steel Ship Builders,
Horse-Nail Works,
Locomotive Works,
Malleable Iron Works,
Cast Iron Pipe Works,
Cast Iron Soil and Plumbers' Pipe Works,
Wrought Iron, Wrought Steel and Riveted Pipe Works,
Seamless Tube Works,
Chain Works,
Bolt, Nut and Rivet Works,
Car Axle Works,
Car Wheel Works, and
Car Builders in the United States.

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AETNA & CORLISS ROLLING MILL ENGINES

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ROCK CRUSHERS

ROLLING MILL & TIN PLATE MILL MACHINERY

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IRON AND STEEL WORKS MACHINERY.

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SAND AND CHILLED ROLLS.

Heavy Iron Castings in Loam, Dry and Green Sand, Made from Cupola or Air Furnace...

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and get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

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MOST FIRE-PROOF
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Used by nearly all the Railroads.

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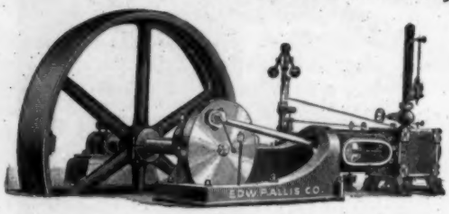

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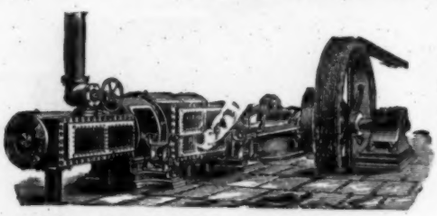
YOUNGSTOWN, OHIO.

The PORTER-HAMILTON ENGINE.



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

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Sennett Compression Coupling

And Other Specialties.

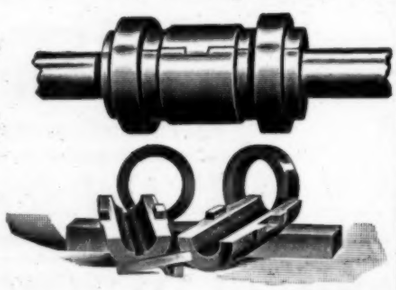
We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.

We make also the

SENNETT ENGINE

20 to 40 H. P.

Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.



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Engineers,
Founders and Machinists.

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Headquarters for **Mill Gearing** of all kind and sizes.

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Perfect Lubricating Metal Co., Cincinnati, O.
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Lorain Foundry Co., Lorain, O.
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Bourne-Fuller Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ills.
American Steel Hoop Co., Pittsburg, Pa.
Champion Iron & Steel Co., Muskegon, Mich.

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Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

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Southwark Foundry & Machine Co., Philadelphia, Pa.
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Cahall Sales Department, Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
Hooven, Owens & Rentschler Co., Hamilton, O.
Harrison Safety Boiler Works Philadelphia.
Meehan Boiler & Construction Co., Lowellville, O
Wm. Cramp & Sons, Philadelphia, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.
James Bonar & Co., Pittsburgh, Pa.
W. P. Davis Machine Co., Rochester, N. Y.
The United Boiler Co., Girard, O.

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BOILER COVERING—
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BOILER TUBE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa

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Upson Nut Co., Cleveland, O.

BOLT CUTTERS—
American Tool Works Co., Cincinnati, O.

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U. Baird Machinery Co , Pittsburg, Pa
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Bickford Drill and Tool Co., Cincin ati, O.
Universal Construction Co., Chicago, Ill.
American Tool Works Co., Cincinnati, O.

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Lorain Foundry Co., Lorain, O.

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Riter-Conley Mfg. Co., Pittsburg, Pa.

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Lidgewood Mfg Co., New York City.

CARS—
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Whiting Foundry Equipment Co., Harvey, Ill.

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American Carburizing Co., New York City.

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Macbeth & Co., Cleveland, O.
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Brass Founders' Supply Co., Newark, N. J.
Schuylkill Lion & Steel Co., Philadelphia, Pa.
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Riverside Foundry Co., Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Lorain Foundry Co., Lorain, O.
Bethlehem Steel Co., South Bethlehem, Pa.

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CASTINGS (BRASS)—
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Lorain Foundry Co Lorain. O.

CASTINGS (BRONZE)—
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Buhl Malleable Co., Detroit, Mich.

CASTINGS (Steel)—
Hercules Steel Casting Co., Harvey, Ill.

CEMENT—
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Reed F. Blair & Co., Pittsburg, Pa.

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John T. Jones & Co., Chicago, Ill.
Cremer & Bicknell, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
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Webster Camp & Lane Machine Co., Akron, O.

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Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
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Cleveland Crane & Car Co., Cleveland, O.

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Danielson Machine & Tool Co., Cleveland, O.

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E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I

DYNAMOS—
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The Aultman Co., Canton, O.
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National Engraving Co., Cleveland, O.,
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Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
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Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass
Danielson Machine & Tool Co., Cleveland, O.
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The Aultman Co., Canton, O.
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Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa

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Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.

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FOUNDRY SUPPLIES—
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Cleveland Crane & Car Co , Cleveland, O.
Thos. Furlow & Son, Philadelphia, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton

Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
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Theo. Hiertz & Son, St. Louis, Mo.
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Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

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Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

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Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
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Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
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GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

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The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co , Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

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F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
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The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

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Jos Dixon Crucible Co., Jersey City, N. J.

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Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

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Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

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Covert Mfg. Co., West Troy, N. Y.

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Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
Wefugo Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co. New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co. New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

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C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

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E. H. Stroud & Co. Chicago, Ill
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

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Berger Mfg. Co., Canton, O.
Ætna Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co., Youngstown, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
F. H. Bultman & Co., Cleveland, O.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANUFACTURING CHEMISTS—
Wefugo Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Champion Iron & Steel Co., Muskegon, Mich.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Cabeen Co., Philadelphia, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co. Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co , Cleveland, O.

MILL CASTINGS—
Vulcan Foundry & Machine Co., New Castle, Pa.
Schuykill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis,
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.
Wm. B. Pollock Co., Youngstown, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE CARS—
The Pressed Steel Co, Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Reed P. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
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Pickands, Brown & Co., Chicago, Ill.
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McKeefrey & Co., Leetonia, O.
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Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,
J. H. Hillman & Son, Pittsburg, Pa.

PIG IRON CASTING APPARATUS—
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G. H. Ginther, Special Agent, Pittsburg, Pa.

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James B. Clow & Sons, Chicago, Ill.

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Wm. B. Pollock Co., Youngstown, O.

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Jenkins Bros., New York City.

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PIPE FOUNDRY PLANTS—
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PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

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W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
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American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.
Illinois Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.
Mossberg & Granville Mfg. Co., Providence, R.I.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
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Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O
Mossberg & Granville Mfg. Co., Providence, R.I.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

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E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLER BEARINGS—
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ROLLING MILLS—
Mossberg & Granville Mfg. Co., Providence, R.I

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. B. Phillips' Sons Co., Philadelphia, Pa
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Vulcan Foundry & Machine Co., New Castle, Pa.
Mossberg & Granville Mfg. Co., Providence, R.I.

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.

SECOND-HAND MACHINERY—
L. K. Hirsch Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.
Geo. D. Moffat & Co., Chicago, Ill.
Torbert & Peckham, Chicago, Ill.

SENSITIVE DRILLS—
American Tool Works Co., Cincinnati, O.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland O.
American Tool Works Co., Cincinnati, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON—
Ætna-Standard Iron & Steel Co., Bridgeport, O
E. H. Stroud & Co., Chicago, Ill.
Republic Iron & Steel Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPIKES—
L. K. Hirsch, Chicago, Ill.

SPECIAL MACHINERY—
American Tool Works Co., Cincinnati, O
James Bonar & Co., Pittsburg, Pa.
Avery Stamping Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill.

STEAM PACKING—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa,

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

STEEL—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

STEEL BALLS—
Cleveland Ball & Screw Co., Cleveland, O.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
National Steel Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
Hercules Steel Casting Co., Harvey, Ill.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
The Wm. B. Pollock Co. Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
The United Boiler Co., Girard, O.

TANK CARS—
The Wm. B. Pollock Co., Youngstown, O.

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

TIN AND TERNE PLATES—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.

TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.

TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

TRAMWAY EQUIPMENT—
Whiting Foundry Equipment Co., Harvey, Ill.

TRANSMISSION MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry & Machine Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

TROLLEY TRACKS—
Whiting Foundry Equipment Co., Harvey, Ill.
Northern Engineering Works, Detroit, Mich.

TRUCKS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TUBES—
National Tube Co., Pittsburg, Pa.
S. Fix' Sons, Cleveland, O.

TUBE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

TUBE WELDING—
S. Fix Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TURNBUCKLES—
Republic Iron & Steel Co., Chicago, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.

TWIST DRILLS—
C. H. Besly & Co., Chicago, Ill.

TWIST DRILL CASES—
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.

WATER SOFTENING PLANTS—
Wefugo Co., Cincinnati, O.

WIRE—
American Steel & Wire Co., Chicago, Ill.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Company, Columbus, O.

WIRE MACHINERY—
S. W. Goodyear, Waterbury, Conn.
Mossberg & Granville Mfg. Co., Providence, R.I.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.

WIRE ROPE FILLING—
The Ironsides Company, Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.

WROUGHT PIPE—
National Tube Co., Pittsburg, Pa.

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Northern Engineering Co	35
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†Ohio Sand Co	—
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†Parkhurst & Wilkinson Co	—
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Union Boiler Tube Cleaner Co	1
United Boiler Co	36
Upson Nut Co	1
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Vulcan Mfg. Co	36
Webster, Camp & Lane Machine Co	25
Webster Fire Brick Co	1
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Whiting Foundry Equipment Co	35
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IRON ORE.

[On Lake Erie Docks.]

Special low-phosphorus hard ore, Bessemer	$6.50
No. 1 Specular, Bessemer	$5.75@ 6.00
No. 1 Bessemer, hematite	5.25@ 5.75
Hematites No. 1 non-Bessemer	4.00@ 4.50
No. 1 Specular, non-Bessemer	4.50@ 4.75
Mesabi Bessemer	4.50@ 4.85

PIG IRON.

Cleveland (f. o. b. cars):

Bessemer	$24.90
No 1 Strong Foundry	$23.00@ 23.50
No. 2 Strong Foundry	22.50@ 23.00
Gray Forge, red short	21.25@ 21.75
No. 1 American Scotch	23.00@ 23.50
No. 2 American Scotch	22.50@ 23.00
Lake Superior Charcoal	25.00@ 26.00

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[Delivered Cleveland.]	GROSS TONS
Old iron rails	$28.00
Old steel rails (6 ft. and over)	21.00
Old steel rails (6 ft. and under)	22.00
Old car wheels	22.00
	NET TONS.
No. 1 R. R. wrought scrap	$25.00
Mill scrap	17.00
No. 1 Machine cast scrap	17.00
Iron axles	28.00
Axle turnings	16.00
Wrought turnings (free from cast)	13.00
Cast borings	11.00
Uncut wrought iron boilers	10.00
Steel boiler plates	16.00
Grate bars	11.00
Pipes and flues (clean)	15.00
Tank Iron	16.00
Hoop and band iron	12.00
Sheet iron	10.00
Wrought drillings	13.00
Malleable Iron	15.00

STRUCTURAL MATERIAL.

Beams and channels (f. o. b. Cleveland)	2.35c
Angles	2.35@ 2.45c
Tees	2.45c
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Sheared plates	2.70c

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If your competitor runs his plant at less cost than yourself, you are giving him an advantage that means either the loss of business or proportionately less profit.

If you haven't

AN AUSTIN SEPARATOR

on your engine, you are not getting the best results from your steam power.

We have good evidence of this in the shape of thousands of testimonials from the largest plants in the country.

An oil separator will save another item. If you use your exhaust it is indispensable—If y u are not using your Exhaust, you are blowing good money into the air.

We ship to responsible parties anywhere in the United States on 30 days' trial and pay freight both ways if our guarantee of satisfactory service is not substantiated.

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"It is true that advertising will not put merit into poor merchandise, but good merchandise often becomes poor for the want of good advertising."

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Hydraulically Forged and Annealed.

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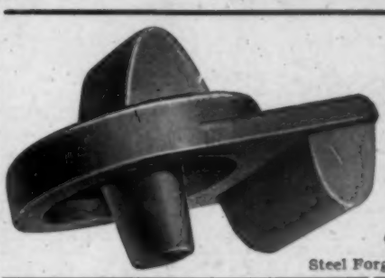

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Worcester, Mass.
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Pressed Forgings,
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Hammer Forgings,
of STEEL, IRON, or COPPER.
Steel Forging, Weight 55 lbs.

FORGINGS.

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HENDERSON & TRAGO, Agents.
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DEALERS IN
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MANUFACTURERS OF
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Special Department for
DEVELOPING INVENTIONS in SECRET.

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carried in stock

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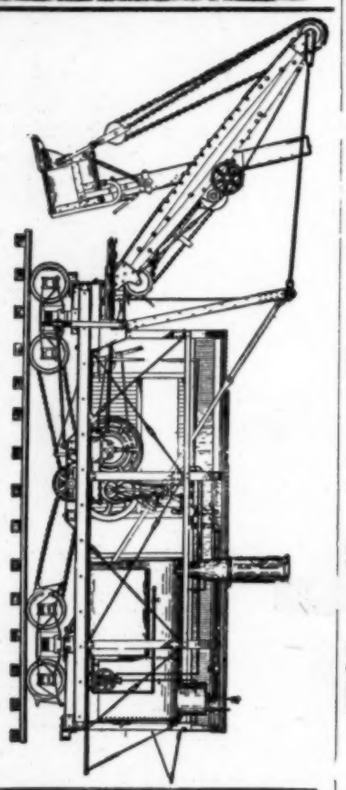

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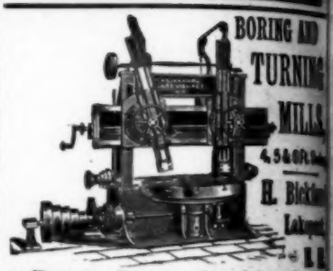

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Write for Photograph and Low Prices.

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Most Efficient and durable. Prices Right.
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